RESIDENT FISH HATCHERIES ANNUAL REPORT

Period Covered: October 1, 1987 to September 30, 1988

September 1989

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RESIDENT FISH HATCHERIES

1987-1988 Annual Report

INTRODUCTION

In the 1987-1988 fish year, Idaho's resident fish hatcheries produced slightly over 3 million catchable trout weighing over 1 million pounds. Fry and fingerling production totaled 233,000 pounds and nearly 25 million fish. On an average, 1.0 pound of fish was produced for each 1.4 pounds of feed (see Production Summary).

Cost of production of all fish was $1.5 million, for an average cost of $1.18 per pound. Cost per pound of catchable fish averaged $0.86, plus an additional $0.11 per pound for tanker distribution. Total cost per pound for fry and fingerlings averaged $2.71.

Major improvements completed during the past year included hatchery renovation plans for Hayspur. Phase One construction, which involves eight brood ponds and an aeration chamber, will commence in May 1989. A well was drilled and test pumped at Hayspur Hatchery. Water from this well will be utilized during Phase Two construction. Ten new fingerling production raceways were completed at Mackay Hatchery. The lower portion of Tucker Springs was enclosed with rock and tile lines at Hagerman Hatchery. Nampa Hatchery added electrical service to the B and C raceway sections to allow for additional water aeration. Two artesian wells were test pumped and found capable of producing at least 10 cfs of water. Pumps will be installed on these wells during June 1989.

A new 24,000-pound feed bin was installed at American Falls Hatchery. Also, the spring at American Falls Hatchery was completely covered to reduce the chance of fish disease pathogens entering the hatchery. A visitor information booth was finished at Grace Hatchery. Clark Fork Hatchery completed a seismic study to determine the availability and location of groundwater. Several of the buildings at Henrys Lake Hatchery received a face-lift, and the property ownership boundaries should be surveyed and established by June 1989. Several of the hatcheries installed new directional signs to help visitors find the hatcheries, and hatchery entrance signs have been installed at most hatcheries.

Visitor numbers totaled approximately 91,700 at all resident hatcheries. Hagerman Hatchery receives as many visitors as all other resident hatcheries combined. A development plan will be completed during the next year to enhance visitor facilities at Hagerman Hatchery.

Author:

Mike Larkin
Resident Hatcheries Supervisor

Idaho Department of Fish and Game
Resident Hatcheries Fish Production
10/1/87 - 9/30/88

Hatchery	Catchable		Fingerlings		Fish food		Total		Feed	Cost/	Cost/
	Number	Pounds	Number	Pounds	Pounds	Costs	pounds	conversion	cost	1000 fish	pound
Hagerman	1,207,662	412,426	1,669,313	51,490	682,775	$142,182	463,916	1.47	$292,400	$101.63	$0.63
Nampa	937,261	204,466	245,041	8,661	323,953	$68,032	213,127'	1.52	$210,800	$187.87	$1.03
American Falls	464,767	158,631	142,854	2,273	212,393	$44,603	160,904	1.32	$156,200	$257.33	$0.97
Mackay	235,681	90,895	2,776,595	64,545	184,973	$56,509	155,440	1.19	$145,700	$48.37	$0.94
Grace	291,145	96,406	583,946	42,275	152,549	$40,078	138,681	1.10	$141,800	$162.06	$1.02
Hayspur	232,406	63,876	906,779	12,401	134,552	$29,005	76,277	1.76	$147,600	$129.70	$1.94
Ashton	49,168	16,374	916,999	9,845	34,200	$10,450	26,219	1.30	$105,300	$109.01	$4.02
Cabinet Gorge			13,027,000	28,670	26,411	$12,686	28,670	1.00	$165,827	$12.73	$5.78
Clark Fork			3,535,477	12,267	29,903	$14,973	12,267	2.44	$133,200	$37.68	$10.86
McCall			612,476	1,091	574	$432	1,091	0.53	$30,500	$49.84	$27.95
Totals	3,418,090	1,043,074	24,416,480	233,518	1,782,283	$418,950	1,276,592	1.38	$1,529,327	$55.22*	$1.18*

Total cost for each hatchery is that hatchery's total budget minus capital outlay expenditures.
*Denotes weighted means

R9F5366BM

AMERICAN FALLS HATCHERY

ANNUAL REPORT

Prepared by:

Gary Baker, Hatchery Superintendent II
Dave Billman, Hatchery Superintendent I

INTRODUCTION

American Falls Hatchery raises catchable (9- to 12-inch) and fingerling (3- to 6-inch) rainbow trout, and fingerling brown trout (3- to 6-inch). Production for the period ending September 30, 1988 was 464,767 9- to 12-inch rainbow trout weighing 153,631 pounds, 82,530 3- to 6-inch rainbow trout weighing 1,575 pounds, and 60,324 3- to 6-inch brown trout weighing 698 pounds (Table 1).

HATCHERY IMPROVEMENTS

1. Installation of a new 24,000-pound bulk feed bin with fines separator. Approximate cost: $6,000.00.

2. The department engineering crew recaptured and covered springs and seeps in the old supply pond area.

3. Interiors of two residences were painted by hatchery personnel.

4. The incubator system in the new hatchery building was remodeled and revamped for better, more efficient operations.

5. A new two-ton truck was purchased.

6. A new wider and taller overhead door was installed in the large shop building.

7. New wiring was installed in the large shop building to accommodate power tools and welder.

FISH HEALTH

Fish health was generally very good during the period; however, once again, an outbreak of systemic bacteria occurred in the fingerling rainbow. This was first noted in the Hayspur fish that are being held for future Hayspur Hatchery broodstock. Subsequent diagnosis by the pathology

staff was as follows: both Bacillus sp. and Micrococcaceae; all isolates are common saprophytes in water and soil and may become opportunistic pathogens. About one week later, these same symptoms began showing in the Mt. Lassen rainbow fingerlings that had just been moved outside. Both hatchery and pathology personnel agree that these conditions are aggravated by strong direct sunlight. These conditions occur every year in June and July about three weeks after the fish have been moved to the outside raceways. If caught early, it can be successfully treated with medicated feed containing 2.5 g per pound of Oxytetracycline. Plans are to install shaded-type bird screening on the upper half of the raceways to alleviate sun stress. All stocks of fish were given a routine yearly inspection for IHNV, IPNV, and whirling disease agents, with negative results on all three.

PUBLIC RELATIONS

Approximately 7,500 persons visited the facility during this period, including the general public and various school, scout, and other tour groups. Three major media contacts were made, including two newspaper articles with photos on general operations and fish planting prior to the opening of general fishing season and one television interview by Channel 6 in Pocatello on the effects of drought conditions on fishing, fish stocking, and fish rearing for next season. New directional and informational signs were installed on the roads leading to the hatchery. A hatchery sign, containing a welcome and information on hatchery operations, was built and installed at the entrance to the facility.

FISH PRODUCTION

Fish production at American Falls Hatchery is limited by water availability during peak loading periods (March, April, May). American Falls has been able to rear approximately 175,000 pounds of 9- to 12-inch rainbow for stocking as catchables statewide. Recently, due to drought conditions, the springs have dropped to as low as 12 cfs during this period. "Normal" water flows vary from 16 cfs to 26 cfs, depending upon weather conditions and American Falls Reservoir water levels. During the last two years, production has been cut back to 150,000 pounds due to low flows and the rearing of Hayspur brood fish. It seems, at least for the present, that optimal loading should remain at this level. Production costs for the past year are shown in Table 3.

Various strains of rainbow have been tried at American Falls, including Trout Lodge, Mt. Whitney, Hayspur, Shepherd of the Hills, Sand Creek, and Mt. Lassen. The best results, as far as overall fish condition, appearance, and conversions, were obtained with 1) Trout Lodge; 2) Hayspur; 3) Shepherd of the Hills; 4) Mt. Lassen; and 5) Mt. Whitney. Availability of eyed eggs and price plays a major role in selections at present. When Hayspur rainbow become available in the next few years, they are probably the best choice for this facility. We are to receive Mt. Shasta rainbow eggs from Ennis NFH during the next rearing cycle and will be able to evaluate them for suitability. Other strains to

be considered are domestic Kamloops and rainbow-cutthroat hybrids from Henrys Lake. Historically, rainbow-cutthroat hybrids did very well in large, southeastern Idaho reservoirs such as American Falls, Blackfoot, Chesterfield, Hawkins, and Daniels. This is a very good, hardy, and fast growing fish and does well at American Falls Hatchery. Egg availability has exceeded demand at Henrys Lake Hatchery in recent years, and this option should receive consideration, particularly for fall fingerling plants. Eggs received last year are shown in Table 2.

During the past season, we have once again attempted to rear brown trout at American Falls. For some reason, either water chemistry or nitrogen supersaturation at 102%-105%, browns do not do well at this facility. Consideration should be given to shifting this species to a hatchery where they have done well in the past. Percentages of survival from hatch to fingerling size is lower than is acceptable for economical rearing at this time (50%-60%).

DIETS

During this report period, three diets were fed at American Falls. All fish were started on Rangens soft-moist formula and were fed the same; up to size 1/16-inch pellet for rainbow and 3/32-inch pellet for browns. This is an excellent starter and early rearing feed. The fish do very well on it, with minimal mortalities and excellent growths and conversions. The extra cost of this feed is more than offset by its benefits for starting and maintaining healthy and vigorous fish. After the rainbow reached two to three inches in length, they were switched to Clear Springs grower diet. Within a week of changing diets, a definite difference could be seen in fish condition, behavior, feeding response, and settleable solids in the rearing tanks. In some cases, the fish actually lost weight, mortalities increased, and settleable solids Increased fourfold. These conditions continued until September when Rangen, Inc. was the successful bidder for the dry diet. Fish conditions and settleable solids began to improve almost immediately upon starting to feed the Rangens feed. Results of a feed comparison study are included in this report.

Table 1. Fish requested and produced.

Species & size	Production goal	Actual production	Percent of goal achieved
Rainbow(R4) 9-12 in.	450,000	464,767	103
Rainbow (R4)_3-6 in.	0	82,530	N/A
Brow Trout (Ply. R.)	75,000	60,324	80

Table 2. Eggs received.

Species & strain	Date received	Source	Number	Percent hatch	Destination & date	Cost
Rainbow R4	3 & 4/'88	Mt. Lassen	750,000	85	Statewide 1988-1989	$3,365
Rainbow R9	Jan. '88	Hayspur	10,000	90	Hayspur SFH	$ 0
Brown Ply. R.	Dec. '87	Ply. Rock	104,000	80	Region 4	$ 780

Table 3. Cost of fish production.

Species & strain	Source	Pounds planted	Destination	Percent budget	Cost
Rainbow R4	Mt. Lassen	158,631	Statewide	92	$168,636
Rainbow R4	Mt. Lassen	1,575	Blackfoot Res.	5	$ 9,163
Brown Ply. Rock	Ply. Rock	698	Region 4	3	$ 5,499

AMERICAN FALLS HATCHERY FEED COMPARISON STUDY

Prepared by:

David Gillman, Fish Hatchery Superintendent I

INTRODUCTION

A feed study was initiated on September 1, 1988 and continued through the months of October and November. The intent of this study was to compare the performance of Mt. Lassen rainbow trout reared at American Falls State Fish Hatchery on two different dry diets. The two diets involved in the study were manufactured by Rangen, Inc. and Clear Springs Feed Co., both of Buhl, Idaho. These are the two contract diets most commonly used at those Idaho Department of Fish and Game fish hatcheries rearing resident fish species.

PROCEDURE

Fish were graded in the hatchery building during the month of July. The largest fish from this grading were moved to outside Raceways 1 and 3. Fish from the second grading, middle-sized fish, were moved to outside Raceways 2 and 4. These fish were allowed to acclimate to their new environment during the remainder of the month of July and the month of August. During this period, all fish were fed Clear Springs diet. Enough fish were added at the end of August to replace any mortalities and to bring the total inventory *in* each raceway to 46,000 fish.

The fish *in* both No. 1 and No. 3 Raceways averaged 24 fish per pound at the onset of the study. The fish in Raceway No. 2 averaged 35 fish per pound, while those in Raceway No. 4 averaged 37 fish per pound at the beginning of the study.

Flows in the four raceways remained equal throughout the study. Flows increased or decreased slightly during the study due to the turning on or off of other raceways not involved in the study. This, however, should have had no effect on the study because each of the four raceways saw an equal portion of the increase or decrease in flow. More than adequate flow for the total pounds of fish in each raceway was available throughout the study.

Water temperature at American Falls Fish Hatchery remains a constant 55 degrees Fahrenheit (12.8^{o}C) year-round. At no time did the density index on any raceway reach the 0.5 limit recommended by Piper et al. (1982).

Rangens dry diet was fed to the trout in Raceways 1 and 2. The trout in Raceways 3 and 4 were fed Clear Springs dry diet. The fish in each raceway were fed four times daily, at 8 and 11 a.m. and at 1 and 4 p.m. Feeding was done by hand to avoid missed feedings due to an automatic feeder malfunction.

Pound count samples were taken on the 10th, 20th, and the last day of the month. Two random 10-pound samples were taken from each raceway and counted. In all instances, both pound counts on a particular raceway varied little from one another and at times were equal. The two counts for each raceway were averaged and total body weight of fish in the raceway was calculated. The formula,

PERCENT BODY WEIGHT TO BE FED = HC/L

presented by Piper et al. (1982), is routinely used at American Falls Fish Hatchery to determine feeding rates. In this formula, HC represents the hatchery constant, and L represents the average length of the fish in the raceway. A hatchery constant of 10 was used throughout the study. The percent body weight to be fed daily, derived from the formula, was multiplied by the total weight of the fish per raceway to give the total daily amount of feed to be fed for that particular raceway. Feed rates were changed on the day following pound counts. The feed for each feeding was weighed into buckets using a Chatillion hanging scale.

The amount of fines in the feeds was sampled by weighing out a 25-pound random sample of feed, then pouring the sample slowly over an inclined screen. The size of the screen mesh was such that the feed could not pass through but would roll to the base of the screen. The fines filtered through the screen were weighed and expressed as a percentage of the original 25 pounds.

All raceways were cleaned daily by sweeping the entire 100-foot length of the raceway. On November 14, 15, and 16, one-liter grab samples of cleaning effluent were taken on each raceway. These samples were taken from the approximate center of the effluent cloud as it reached the lower screen. Each of these samples were allowed to settle for 30 minutes in an Imhoff one-liter graduated cone. The total amount of settleable solids was recorded after the 30-minute settling time. Any mortalities were also removed and recorded during cleaning.

Six fish each were sacrificed from Raceways 1 and 3 at the end of the study. These fish were taken at random from the raceways. The fish were weighed and total length measurements were taken. The overall body composition and condition were noted. These fish were then autopsied to compare the condition of various organs and systems. Ron Goede's (Utah Division of Wildlife Resources) method of autopsy and condition were used for this procedure.

RESULTS

The fish that were fed Rangens diet received 10,244.5 pounds of feed, and gained a total of 9,317 pounds during the study for a feed conversion ratio of 1.10 to 1. Fish fed the Clear Springs diet received 9,475 pounds of feed and gained 8,039 pounds for a conversion ratio of 1.18 to 1 overall. (See Table 1 for a breakdown by raceway.) Clear Springs feed showed both the worst and the best conversions with ratios of 1.30 to 1 and 1.06 to 1, respectively, in Raceways 3 and 4. The conversion ratios for the Rangen-fed raceways were 1.08 to 1 and 1.12 to 1, respectively, for Raceways 1 and 2.

Clear Springs feed proved to be the dustier of the two feeds. Clear Springs 3/32 sack feed contained 3% fines, and their 4/32 sack feed contained 3.6% fines. A sample of Clear Springs 4/32 bulk feed produced 10.4% fines. This bulk feed was not used in the study since it was over 30 days old. It was sampled to compare fines content with Rangens bulk feed in the same size.

Rangens 3/32 sack feed produced 1.75% fines. Samples of their 4/32 size bulk feed produced 2% fines. All Rangens 4/32 size feed used in the study was purchased in bulk rather than sacks.

The results of the cleaning effluent grab samples are outlined in Table 2. Cleaning samples were taken to give some method of comparison to the amounts of effluent that collect in the raceways daily using the different feeds.

The total mortalities for the various raceways during the study were as follows: Raceway No. 1, 350; Raceway No. 2, 147; Raceway No. 3, 378; and Raceway No. 4, 164. The total for the Rangen-fed raceways was 497, while the total for the Clear Springs raceways was 542 mortalities.

The autopsy portion of the study showed the Rangen-fed fish to be heavier per mm of body length. The Rangen-fed samples averaged 0.39 g per mm of body length, while the Clear Springs-fed samples averaged 0.33 g per mm of body length.

Fifty percent of pelvic and pectoral fins on the Clear Springs-fed fish examined showed severe clubbing or total abrasion. The Rangen-fed fish showed fraying and moderate clubbing in 50% of the pelvic and pectoral fins. No severe clubbing or total erosion was evident in the sample of Rangen-fed fish.

Internal organs, in general, looked good in samples fed on both brands of feed. There was more fat associated with the mesenteries in the Rangen-fed samples. In all cases, over 50% of the ceca was fat covered in Rangen-fed fish. The Clear Springs-fed samples showed more diversity in the amounts of mesentery fat. Two fish from the Clear Springs-fed sample had ceca less than 50% covered, one had over 50% of the ceca covered, and three had ceca with 50% coverage. The hindgut in three of the Clear Springs-fed samples appeared larger than normal. The livers in the Clear Springs-fed fish were slightly paler in color than those of the Rangen-fed fish, with one being generally discolored.

DISCUSSION

The fish fed the Rangens diet showed a better overall conversion ratio at 1.10 to 1 than did the Clear Springs diet-fed fish at 1.18 to 1 overall. More divergence was found between the conversion ratios of the two raceways on the Clear Springs diet than between the two different brands of feed. The larger fish on the Clear Springs diet had a conversion ratio of 1.30 to 1, as compared to the smaller fish on the same diet which had a conversion ratio of 1.06 to 1. While a conversion of 1.30 to 1 is still in the realm of acceptability, it is considerably higher than that experienced with any of the other experimental groups.

The fish in the two raceways fed the Rangens diet had very similar overall conversion ratios. Raceway No. 1, with the larger fish, had a conversion ratio of 1.08 to 1; while Raceway No. 2 had a conversion ratio of 1.12 to 1 overall. This would seem to indicate that more consistent overall feed conversion rates could be experienced using Rangens feed.

All samples of Clear Springs feeds exceeded the 2Z fines limit of the feed contract. The 4/32 sack feed manufactured with the high pressure dies produced more fines at 3.62 than did the 3/32 sack feed (3Z) made with the old type dies. Although Clear Springs 4/32 size bulk feed was not fed during this study, it was sampled for fines content to compare with Rangens 4/32 size bulk feed. The 4/32 Clear Springs feed produced 10.4% fines. Rangens bulk 4/32 feed produced a marginally acceptable 2% fines. Rangens 4/32 bulk feed was fed during the study. Rangens 3/32 sack feed produced 1.75% fines. These fines float down the raceway and out into the effluent settling pond and are of no benefit to the fish. Fluctuations in the amount of fines can account for some variation in feed conversion rates. Piper et al. (1982) state, "Because fish feeds are very fragile in comparison to feeds for other animals, up to three percent fines can be expected from normal handling. Excess fines are the result of rough handling or poor physical characteristics of the feed."

The Clear Springs feed also produced much more sediment on the raceway floors. Daily cleaning took almost twice as long per raceway in the Clear Springs-fed fish than in the Rangen-fed fish due to the greater sediment loads. Cleaning often had to stop in mid-raceway to allow clearing so the fish would swim to the upper part of the raceway above the cleaning and effluent in the Clear Springs raceways. This was not necessary in the Rangen-fed raceways as the effluent cloud was not so dense as to cause the fish to crowd the lower screens ahead of it. The fish in the Rangen-fed raceways were moving up the raceway continuously during cleaning.

Cleaning times on the four raceways were recorded during the course of the study. The raceways where Rangens feed was used could be swept top to bottom in four minutes. The Clear Springs fed raceways took seven minutes to clean on the average. Three minutes may seem insignificant but it would amount to 30 minutes per day if all raceways were fed Clear Springs feeds. This would work out to 182.5 man-hours per year, or 4 1/2 weeks of extra cleaning per year.

According to Piper et al. (1982), "A number of undesirable situations can arise when waste feed and fecal material collect in rearing units. If fish feed falls into waste material on the pond or raceway bottoms, fish will generally ignore it and it will be wasted. Excessive feces and waste food harbor disease organisms and can accumulate in the mucus of the gills, especially during disease outbreaks. Disease treatment is also difficult in filthy rearing units because treatment chemicals may react with the organic matter, reducing the potency of the chemical. The waste material may become stirred up as the chemical is mixed in the water; this can be hazardous to the gills of the fish."

The mortality numbers were very similar in Raceways 1 and 3 as well as in Raceways 2 and 4. These numbers, especially in Raceways 1 and 3, are somewhat higher than might be expected at this hatchery. Fifteen fish each from Raceways 1 and 3 were taken for routine autopsy by the Fish and Game fish pathologist. Systemic bacteria were found in lesions on some fish. Nitrogen supersaturation of 104 to 105% is thought to play a role in this recurring problem by weakening the immune systems of the fish, making invasion by normal soil and water-born bacteria possible. Mortalities are normally very low except in the months of June, July, and at times in August when the fish are first moved outside. This year, mortalities rose slightly again in September and October and were back to normal in November. It is encouraging to see that neither of the feeds used seemed to prolong or increase the problem.

At the end of the study, the body condition of the fish on Rangens diet was good. These fish were noticeably heavier bodied, and the pectoral and pelvic fins were in better condition, with lesser degrees of clubbing and abrasion than seen in the samples of Clear Springs-fed fish. One of the six fish sampled had all its fins with no clubbing and very little fraying. At least 50% of the pelvic and pectoral fins on the Clear Springs-fed samples were severely clubbed or totally abraded. One fish was so badly abraded that the pectoral fin area was one large lesion.

The condition of the gills, pseudobranchs, thymus, mesentery fat, spleen, hindgut, kidney, liver, and bile were noted (see Attachment 1). The fish sampled from the Rangen-fed raceways appeared normal internally in all cases, with mesentery fat covering over 501 of the ceca.

In the Clear Springs-fed fish, one fish had a slightly inflamed pseudobranch. Half had approximately 50% fat on the mesentery, one had over 501 fat, and two had less than 50% fat covering the mesentery. The hindgut in three of the samples appeared to be somewhat enlarged. One had a liver that was generally discolored. All fish sampled that had been fed Clear Springs diet had a liver color that was slightly lighter than any of the Rangens diet fish exhibited. The lighter color may be due to a lower crude fat content in the diet of the Clear Springs-fed fish.

Comparison of the guaranteed analysis of 3/32 pellets shows Rangens feed to contain not less than 401 crude protein as compared to 36% for Clear Springs. Rangens feed contains not less than 12% crude fat, compared to 7% in Clear Springs diet. According to Piper et al. (1982), trout and salmon do best on 121 fat and 401 protein diet in fingerling feeds and 91 fat and 351 protein diet in production feeds for older fish.

Rangens 3/32 pellet contains 5% crude fiber, and Clear Springs feed in 3/32 contains 8% fiber. Piper et al. (1982) say, "It is recommended that crude fiber not exceed 10% in fish feeds and preferably not more than 5 or 6%. Some fiber is useful, however, because it supplies bulk and facilitates the passage of food through the fish."

An interesting note is that lignin sulfonate, used as a binder, is the seventh ingredient in the Clear Springs list, while it is the twenty-ninth ingredient in the Rangens list. This binder is probably responsible for the increased solids found in the Clear Springs-fed raceways.

SUMMARY

In this study, both Rangens and Clear Springs feed performed acceptably in terms of overall feed conversion ratios. Rangens conversion was 1.10 to 1 overall and Clear Springs was 1.18 to 1 overall. The conversion ratios for the two Rangen-fed raceways were more consistent at 1.08 to 1 and 1.12 to 1, respectively, while conversion ratios for Clear Springs feed by raceway were 1.06 to 1 and 1.30 to 1.

Rangens feed was better overall when taking into account conversions, amount of fines associated with the feed, the amount of waste products that accumulate in the raceways, and the general appearance and body condition of the fish.

LITERATURE CITED

Piper, R.G., Z.B. McElwaine, L.E. Orme, J.P. McCraren, L.G. Fowler, and J.R. Leonard. 1982. Fish Hatchery Management. United States Department of the Interior, Fish and Wildlife Service. Washington D.C. 517 pp.

Table 1. Conversion rates.

Raceway	Pounds fed	Weight gained (lbs.)		Conversion
		Rangens Feed		
No. 1	5,528	5,106		1.08 to 1
No. 2	4,176.5	4,211		1.12 to 1
TOTAL	9,704.5	9,317	OVERALL	1.10 to 1
		Clear Springs Feed		
No. 3	5,019	3,858		1.30 to 1
No. 4	4,438	4,181		1.06 to 1
TOTAL	9,457	8,039	OVERALL	1.18 to 1

Table 2. Effluent samples.

	Rangens diet		Clear Springs diet	
Date	Raceway 1	Raceway 2	Raceway.3	Raceway 4
11-14	0.6 ml/1	0.5 ml/l	2.0 ml/l	1.25 ml/1
11-15	0.7 ml/1	0.7 ml/1	4.0 ml/1	2.8 ml/l
11-16	1.6 ml/1	1.0 ml/1	3.25 ml/1	4.5 ml/ 1

AUTOPSY CLASSIFICATION

Length: Total length in millimeters

Weight: Weight in grams

Ktl: $= \frac{W \times 10^5}{L^3}$

Eyes: Normal (N), Exopthalmia (E1, E2), Hemorrhagic (H1, H2), Blind (B1, B2), Missing (M1, M2), Other (OT)

Gills: Normal (N), Frayed (F), Clubbed (C), Marginate (M), Pale (P), Other (OT)

Pseudobranchs: Normal (N), Swollen (S), Swollen & Lithic (S&L), Inflamed (I), Other (OT)

Thymus: No Hemorrhage (0), Mild Hemorrhage (1), Severe Hemorrhage (2)

Mesentery Fat: Internal body fat expressed with regard to amount present;

0 - None
1 - Little, where less than 50% of each cecum is covered
2 - 50 % of each cecum is covered
3 - More than 50 % of each cecum is covered
4 - Ceca are completely covered by large amount of fat

Spleen: Black (B), Red (R), Granular (G), Nodular (NO), Enlarged (E), Other (OT)

Hind Gut: No inflammation (0), Mild inflammation (1), Severe inflammation (2)

Kidney: Normal (N), Swollen (S), Mottled (M), Granular (G), Urolithiasis (U), Other (OT)

Liver :

A - Red
B - Light red
C - "Fatty" Liver ; "coffee with cream" color; "greasy" to feel
D - Nodules in liver
E - Focal discoloration
F - General discoloration
OT - Other

Bile:

0 - Yellow or straw color; bladder empty or partially full
1 - Yellow or straw color; bladder full, distended
2 - Light green to "grass" green
3 - Dark green to dark bluegreen

Blood:

Hematocrit - Volume of red blood cells (erythrocytes) expressed as percent of total blood volume. Centrifuged 5 min.

Leucocrit - Volume of white blood cells (leucocytes) expressed as percent of total blood volume.

Plasma Protein - Amount of protein in plasma, expressed as gram percent (grams per 100 ml). Determined with hand-held protometer.

FISH AUTOPSIES

Wildlife Resources
1/87 FES - 25

Date 12-6-88 Unit RW-1
Location American Falls Hatchery
Mark/Lot Rangen feed
Investigator(s) ATT
Reason for Autopsy feed study results

Species Rb R4 Strain Mt. Lassen
Fish Source Mt. Lassen Age 9 mo.
Egg Source Hat.Date
Water Temp 55°F Water Hardness

Quality Control #
Case History #
Tissue Collection #
Disease Survey # Custody #
Remarks

Samp No.	Lgth mm	Wght gm	K_{tl}	Eye	Gill	Pabr	Thym	Fat	Spl	Hind Gut	Kid	Liv	Bil	Sex	Hem	Leuc	S. Pro		Remarks
1	185	63		N	N	N	0	3	B	0	N	A	0	M					
2	190	89		N	N	N	0	3	R	0	N	A	0	0					
3	198	91		N	N	N	0	3	R	0	N	A	0	0					
4	188	72		N	N	N	0	3	R	0	N	A	0	M					
5	170	60.5		N	N	N	0	3	R	0	N	A	0	0					
6	159	50		N	N	N	0	3	R	0	N	A	0	0					
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14																			
15																			
16																			
17																			
18																			
19																			
20																			

GENERAL REMARKS

Fins Some clubbing and fraying.
Skin Normal
Gonads Normal
Other

FISH AUTOPSIES

Wildlife Resources
1/87 FES - 25

Date 12-6-88 Unit RW-3
Location American Falls Hatchery
Mark/Lot Clear Springs feed
Investigator(s) All
Reason for Autopsy feed study results

Species Rb R4 Strain Mt. Lassen
Fish Source Mt. Lassen Age 9 mo.
Egg Source Hat.Date
Water Temp 55°F Water Hardness
Remarks

Quality Control #
Case History #
Tissue Collection #
Disease Survey # Custody #

Samp No.	Lgth mm	Wght gm	K_{tl}	Eye	Gill	Pebr	Thym	Fat	Spl	Hind Gut	Kid	Liv	Bil	Sex	Hem	Leuc	S. Pro		Remarks
1	165	56		N	N	N	0	2	B	0	N	A	0	M					
2	173	56		N	N	I	0	2	B	0*	N	A	0	M					*Hind gut appears
3	172	55		N	N	N	0	1	R	0*	N	F	0	M					larger than normal.
4	190	72		N	N	N	0	1	R	0	N	A	0						
5	172	58		N	N	N	0	3	B	0*	N	A	0						
6	160	46		N	N	N	0	2	R	0	N	A	0						
7																			
8																			
9																			
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14																			
15																			
16																			
17																			
18																			
19																			
20																			

GENERAL REMARKS

Fins 50% severely clubbed or missing.
Skin Normal except for sore fin areas.
Gonads
Other Hind gut in some seems larger than normal.

ASHTON HATCHERY

ANNUAL REPORT

Prepared by:

Paul E. Abbott, Fish Hatchery Superintendent II
Mel Sadecki, Fish Hatchery Superintendent I

INTRODUCTION

Ashton Hatchery is located in Fremont County, Idaho, approximately two miles (3.2 km) southwest of the small community of Ashton. Constructed in 1920, Ashton Hatchery serves as a "specialty station," rearing seven species of trout and salmon, including rainbow, cutthroat, brook trout, brown trout, grayling, golden trout, and kokanee salmon.

The majority of fish produced at Ashton are fry and fingerlings (1 to 6 inches), distributed throughout Idaho as part of various put-grow-and-take management programs. Catchable size (9 to 10 inches) trout are also reared at Ashton and distributed locally in waters managed on a put-and-take basis.

HATCHERY IMPROVEMENTS

Major hatchery repairs and improvements this year included the installation of new thermopane windows in Residence No. 1 and a new steel roof on Residence No. 2. The office and crew quarters were also upgraded with the installation of new carpeting and a kitchenette unit. New equipment purchases included a four-wheel-drive diesel tractor, equipped with a rear mower deck and rotary snowblower for year-round grounds maintenance.

PUBLIC RELATIONS

An estimated 1,500 people visited Ashton Hatchery this year as compared to approximately 1,800 visitors last year. Hatchery personnel provided tours for several local school and scouting groups. Efforts are currently underway to increase visitor traffic and general interest in hatchery operations through the use of new informational signs, hatchery brochures, and greater use of multi-media news releases.

Tremendous interest was shown in the kokanee spawning operations at Moose Creek this summer. 'During just 27 days of operation, an estimated 1,100 people visited the trap site. Personnel were on hand throughout this period to provide information and answer questions. Public support for the program was very favorable.

GENERAL CULTURE TECHNIQUES

Due to the undomesticated nature of the fish reared at Ashton, initial feed training with conventional dry diets is difficult. Therefore, all fish are fed a more palatable Rangens semi-moist diet. Due to their extremely small size, grayling are started on Bio-Products semi-moist feed, which is available in a smaller pellet size, and then switched to the Rangens diet after a few weeks. With the exception of the Arlee strain rainbow, all stocks remain on the semi-moist diet until release. The Arlee fish are switched to a conventional dry diet at approximately five inches. This diet maintains favorable growth rates at a considerably reduced cost.

All lights situated over the nursery vats are operated at a low intensity. This technique is thought to improve feed response, growth rates, and feed conversions by reducing stress on light intolerant species such as brook trout, brown trout, and Henrys Lake cutthroat. Growth rates in these species declined after transfer to outdoor raceways, where no shade was provided.

FISH PRODUCTION

Gross fish production at Ashton Hatchery totaled 1,062,024 fish (48,784 pounds, 22,128 kg) this year. This total met or exceeded nearly all requests for fish during the 1987-1988 fish year (Table 1). Despite meeting nearly all production goals, gross production declined by 49.1% from the 2,086,533 fish produced in 1987. This decline resulted from significant reductions (60.52) in the numbers of fish (primarily cutthroat) requested by the Regional Fishery Manager. Should local stocking requests continue at this reduced level in the future, kokanee and Kamloops production may increase accordingly to help fill stocking requests in northern Idaho.

Aside from kokanee eggs collected at Moose Creek, all fish reared at Ashton were received as eyed eggs. A summary of eggs received and respective survival rates is presented in Table 2.

A total of 34,200 pounds (15,513 kg) of feed were used to produce a weight gain of 22,710 pounds (10,301 kg) for an overall conversion of 1.51:1. Production costs (excluding capital outlay) totaled $106,899.00, with $10,450.00 spent on fish feed and the remaining $96,449.00 spent on personnel costs and general hatchery operations. Overall cost per pound of fish production was $2.34. Average cost per pound of fry, fingerling, and catchable production was $3.13, $5.87, and $1.53, respectively (Table 3).

FISH HEALTH

Fish health during the 1987-1988 fish year was very good. A facility inspection was conducted by Department personnel from the Eagle Fish Health Laboratory on August 30, 1988. Samples were collected from all stocks of fish on hand and examined for as many as five bacterial and viral pathogens. Results of these tests were all negative (Table 4); however, on-site examinations did identify a low-grade bacterial gill infection and a dietary folic acid deficiency in the Kamloops and brook trout stocks. Recommended treatment with copper sulfate (six-ounce flush per vat for three days) and feeding a more freshly milled diet was successful in alleviating the problem. Mortality throughout this period was quite low (<11).

Adult kokanee broodstock from Moose Creek were also sampled on this date for IHN, IPN, and BKD. Test results were positive (3 of 60) for BKD and, consequently, all eggs collected from these adults were destroyed to prevent possible contamination of other fish reared at Ashton.

SPECIAL PROJECTS

Kokanee

For the second consecutive year, personnel from Ashton Hatchery operated a kokanee trap on Moose Creek, a tributary to the North (Henrys) Fork Snake River. The trap was located approximately 3 miles (4.8 km) from Macks Inn, just downstream from the Big Springs Road.

Trapping began on August 9 and continued through September 7, 1988, during which time an estimated 4,000 kokanee were trapped. Trapping and spawning operations were terminated prematurely at the request of the U.S. Forest Service when forest fires in the vicinity forced the evacuation of the area. Length frequency of trapped fish ranged from 13.2 inches (355 mm) to 16.9 inches (430 mm). Mean total length of females trapped was 14.5 inches (369 mm) (Figure 1), while males were slightly larger at 15.3 inches (389 mm) (Figure 2).

Spawning operations began on August 24 and continued on an every-other-day basis through September 5, 1988. A total of 429 females were spawned, yielding 354,505 green eggs (Table 5). Unfortunately, all eggs collected this season were destroyed after routine diagnostic testing by the Eagle Fish Health Laboratory confirmed the presence of bacterial kidney disease in the adult fish (see Fish Health). To ensure fulfillment of kokanee production goals for 1989, approximately 300,000 eyed kokanee eggs collected at Deadwood Reservoir were obtained from Mackay Hatchery to replace the destroyed Moose Creek stock.

All kokanee fry resulting from the 1987 spawning operations were released in Moose Creek immediately upstream from the trap site. To ensure that these fish would imprint on Moose Creek, fry were treated with

a morpholine drip for 14 days prior to release. After release, the morpholine drip was continued for 14 days in Moose Creek. Fry releases were done in late June to coincide with zooplankton blooms in Island Park Reservoir.

Brook Trout

Prior to release, all Temiscamie strain brook trout received a right pelvic fin clip for both strain and year class identification. To ensure desired imprinting, these fish were also treated with a morpholine drip for 14 days prior to release in the fish ladder at Henrys Lake Hatchery. This treatment was continued for 14 days in the ladder.

Cutthroat

All cutthroat fingerlings were marked with an adipose fin clip prior to release into the Teton River. This work was done as part of a research project conducted by Department personnel to evaluate survival and contribution to the fishery of hatchery-reared cutthroat trout. All fish were released between Spring Hollow and Victor.

Grayling

While most literature indicates that grayling are difficult to culture, their relative success at Ashton was quite good. The mean monthly length increase for grayling was 0.539 inches (13.69 mm), second only to the Arlee strain rainbow (Table 6). Feed conversion was also quite good at 1.27:1. Overall survival was only 42.7X; however, 25% of this loss occurred during the eyed egg stage and was attributed to poor egg quality. Factors which appear to be crucial to the success of this program include: initiation of feeding within three days of hatching, availability of a diet (Bio-Products, Biodiet) small enough to be easily consumed by swim-up fry, and relatively warm water 50^{o}F (10^{o}C) available at Ashton.

Tiger Muskie

During the spring and fall of 1988, personnel from Ashton Hatchery had the opportunity to assist regional personnel with the introduction of tiger muskie to Idaho at Mud Lake.

In April, a small holding pond was established adjacent to Mud Lake and inoculated with zooplankton to serve as an early rearing area for the fish. On May 3, approximately 100,000 sac fry were received from Iowa and stocked directly into the pond. Unfortunately, heavy mortality during transport resulted in 95+% fish loss. On May 6, a second group of

approximately 50,000 sac fry was received and brought directly to Ashton Hatchery for temporary holding. Fry were held in vats lined with astroturf for six days (without feed) until swim-up, at which time they were transferred to the pond at Mud Lake. Irrigation drawdown of the water table, compounded by drought conditions, resulted in dewatering of the pond and loss of the second release group.

A successful release of approximately 28,500 tiger muskie fingerlings (4- to 6- inches) was accomplished on June 24 by fish transportation crews. Ashton Hatchery personnel participated in one additional stocking effort on September 16. This final group (2,772 fish at 90/pound and 1.031 fish at 41.3/pound) was received from Mossy Rock Hatchery in Washington and scatter planted in Mud Lake by means of an airboat. All fingerling tiger muskie were transported in a 0.0252 saline solution to reduce stress.

Table 1. Fish requested and produced, Ashton Hatchery 1987-88.

SPECIES	SIZE	NUMBER REQUESTED	NUMBER PRODUCED	POUNDS PRODUCED	PERCENT OF GOAL	DESTINATION
rainbow	8-10"	109,500	104,645	35,806	96%	Region 6
rainbow	2-3"	196,000	196,962	1,910	100%	Henrys Fork tributaries
Kamloops (K1)	3-4"	106,000	106,448	1,849	100%	Winchester Lake
Kamloops (K2)	3-4"	6,000	17,500	299	292%	Elk Creek Reservoir
brown	3-4"	90,000	126,228	835	140%	Henrys Fork/Willow Creek
brook (Temisc)	3-4"	100,000	101,583	1,971	102%	Fish ladder, Henrys Lk. Hatchery
brook (Nat)	3-4"	0	5,966	175		Duck Cr./Kelly Springs Cr.
cutthroat	2-3"	150,000	156,142	1,027	100%	Teton River
kokanee	1-2"	125,000	129,920	1,160	104%	Moose Creek
grayling	1-2"	32,500	76,250	23	235%	mountain lakes
golden*	1-2"	6,250	1,280	2	0%	None stocked, insufficient eggs received
rainbow*	8-10		39,100	3,727		Region 6, to be stocked 5/89
GROSS PRODUCTION'		921,250	1,062,024	48,784	115%	
NET PRODUCTION`			966,167	26,219		

* fish on hand at end of FY 87-88.

' equal to fish stocked + fish on hand at end of FY.

• equal to gross production - fish received - fish carried from previous FY.

Table 2. Fish or Eggs received and survival to stocking, Ashton Hatchery 1987-88.

SPECIES	STRAIN/SOURCE	DATE RECEIVED	NUMBER RECEIVED	NUMBER STOCKED	PERCENT SURVIVAL	COMMENTS
rainbow'	Arlee/Ennis NFH	12-86	50,132	49,168	98.1%	Surv. calc. from 10/1/87 to stocking
rainbow*	Arlee/Ennis NFH	12-87	308,320	196,962	76.6%	Surv. calc. to end of FY 87-88
Kamloops	Skanes Fish Farm	11-87/2-88	149,963	106,448	71%	
Kamloops	Dunc. River/Ennis NFH	2-88	25,090	17,500	69.7%	
brown	Ply, Rock/Ply. Rock	12-87	117,504`	126,228	100%	
brook	Temisc./Henrys Lk.	12-87	120,473	101,583	84.3%	
brook	Native/Henrys Lk.	11-87	*36,976*	5,966	16.1%	
cutthroat	Henrys Lk./Henrys Lk.	4-88	203,378	156,142	76.8%	
grayling	Mdw. Lk./Wyoming	6-88	178,500	76,250	42.7%	
golden*	wild/Wyoming	7-88	2,364	0	54.1	Surv. calc. to end of FY 87-88
kokanee	wild/Moose Creek	9-87	164,744	129,920	78.9%	
TOTAL			1,357,444	966,167	71.2%	

' fish carried from previous FY. *
fish on hand at end of FY 87-88.

• denotes initial inventory error.

Table 3. Production costs by species and size, Ashton Hatchery, 1987-1988.

Species/strain	Size (inches)	Number produced	Pounds produced	Percent of budget	Total cost	Cost/ pound	Comments
Rainbow[a] (RA)	9.5	39,100	3,727	16.3	$17,200	$ 4.61	
Rainbow (RA)	5.3	49,168	13,241	28.7	$30,237	$ 2.28	To be stocked 5/89
Rainbow (R4)	9.5	55,477	19,432	8.0	$8,371	$ 0.43	Received from Grace
Subtotal		143,475	36,400	53.0	$55,808	$ 1.53	
Rainbow (RA)	3.1	196,962	1,910	12.5	$13,163	$ 6.89	
Kamloops (K1)	4.4	106,448	1,849	6.7	$ 7,055	$ 3.81	
Kamloops (K2)	3.5	17,500	299	1.1	$	$ 3.87	
Brown (BN)	2.5	126,228	835	7.9	$ 8,319	$ 9.96	
Brook (Temiscamie)	3.6	101,583	1,971	6.4	$ 6,739	$ 3.42	
Brook (Natural)	4.4	5,966	175	0.4	$ 421	$ 2.41	
Cutthroat (C3)	2.5	156,142	1,027	9.9	$10,425	$10.15	
Golden[a] (GN)	1.8	1,280	2	0.1	$ 105	$52.50	
Subtotal		712,109	8,068	45.0	$47,385	$ 5.87	
Kokanee (KE)	3.0	129,920	1,160	1.6	$ 3,285	$ 2.83	
Grayling (GR)	1.6	76,250	23	0.4	$ 421	$18.30	
Subtotal		206,170	1,183	2.0	$ 3,706	$ 3.13	
TOTAL		1,061,754	45,651	100.0	$106,899	$ 2.34	

[a] Fish on hand at end of FY 1987-1988.

Table 4. Pathology test results, Ashton Hatchery, 1988.

Species/strain	Sample date	IHN	IPN	PW	PC	BKD	Comments
Rainbow (RA)	8-30-88						
Brook (Natural)	8-30-88			0	0		Bacterial gill & folic acid deficiency
Kamloops (K1)	8-30-88			0	0		Bacterial gill & folic acid deficiency
Kamloops (K2)	8-30-88			0	0		Bacterial gill & folic acid deficiency
Golden (GN)	8-30-88			0	0	0	
Grayling (GR)	8-30-88			0	0	0	
Kokanee (KE)	8-30-88			0	0	+	Eggs destroyed

LEGEND:

IHN = Infectious hematopoietic necrosis virus
IPN = Infectious pancreatic necrosis virus
PW = Whirling disease Myxobolus cerebralis
PC = Ceratomyxosis Ceratomyxa shasta

+ = Positive results -
= Negative results
* = Testing in progress
0 = Not tested

Table 5. Results of kokanee spawning operations at Moose Creek, 1988.

DATE	FEMALES SPAWNED	EGGS COLLECTED	AVERAGE FECUNDITY	PERCENT EYE-UP
8-24-88	191	154,687	809	*79.9%*
8-26-88	37	30,268	818	77.2%
8-29-88	37	32,050	866	85.6%
8-31-88	40	30,625	766	87.9%
9-2-88	40	33,125	828	#
9-5-88	84	73,750	878	#
TOTAL	429	354,505	mean=826	

Eggs destroyed prior to eye-up.

Table 6. Comparative growth rates and feed conversions for all species reared at Ashton Hatchery, 1987-88.

SPECIES	AVE. MONTHLY LENGTH INCREASE	AVERAGE CONVERSION
rainbow	0.59"	1.40
grayling	0.54"	1.27
Kamloops (K1)	0.44"	1.53
brook (Nat)	0.44"	1.99
Kamloops (K2)	0.40"	1.49
brook (Temisc)	0.39"	1.53
kokanee	0.35"	1.88
cutthroat (C3)	0.32"	1.22
brown	0.30"	1.55
golden	0.25"	4.20

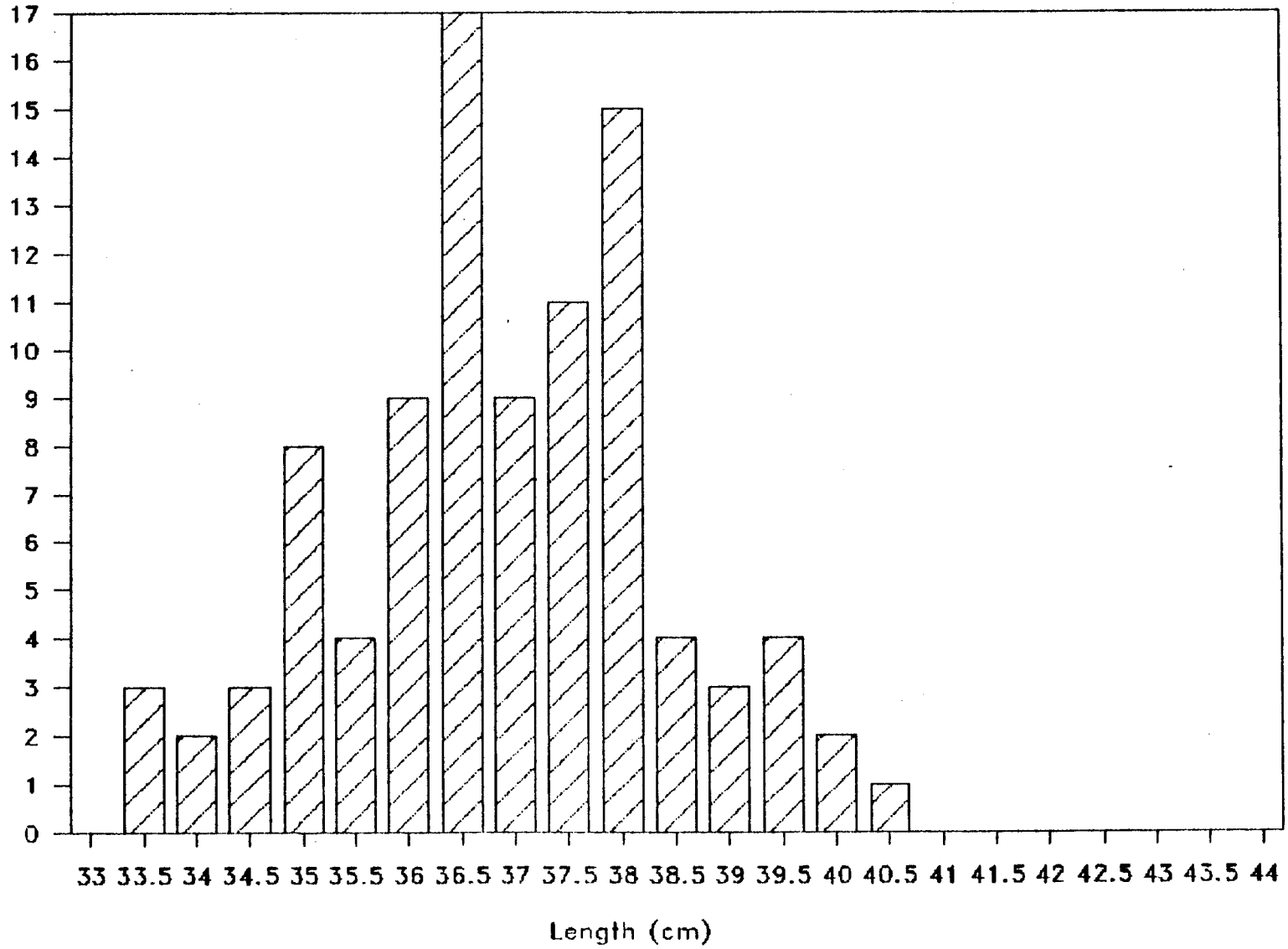

Figure 1. Length frequency of female kokanee trapped at Moose Creek, 1988.

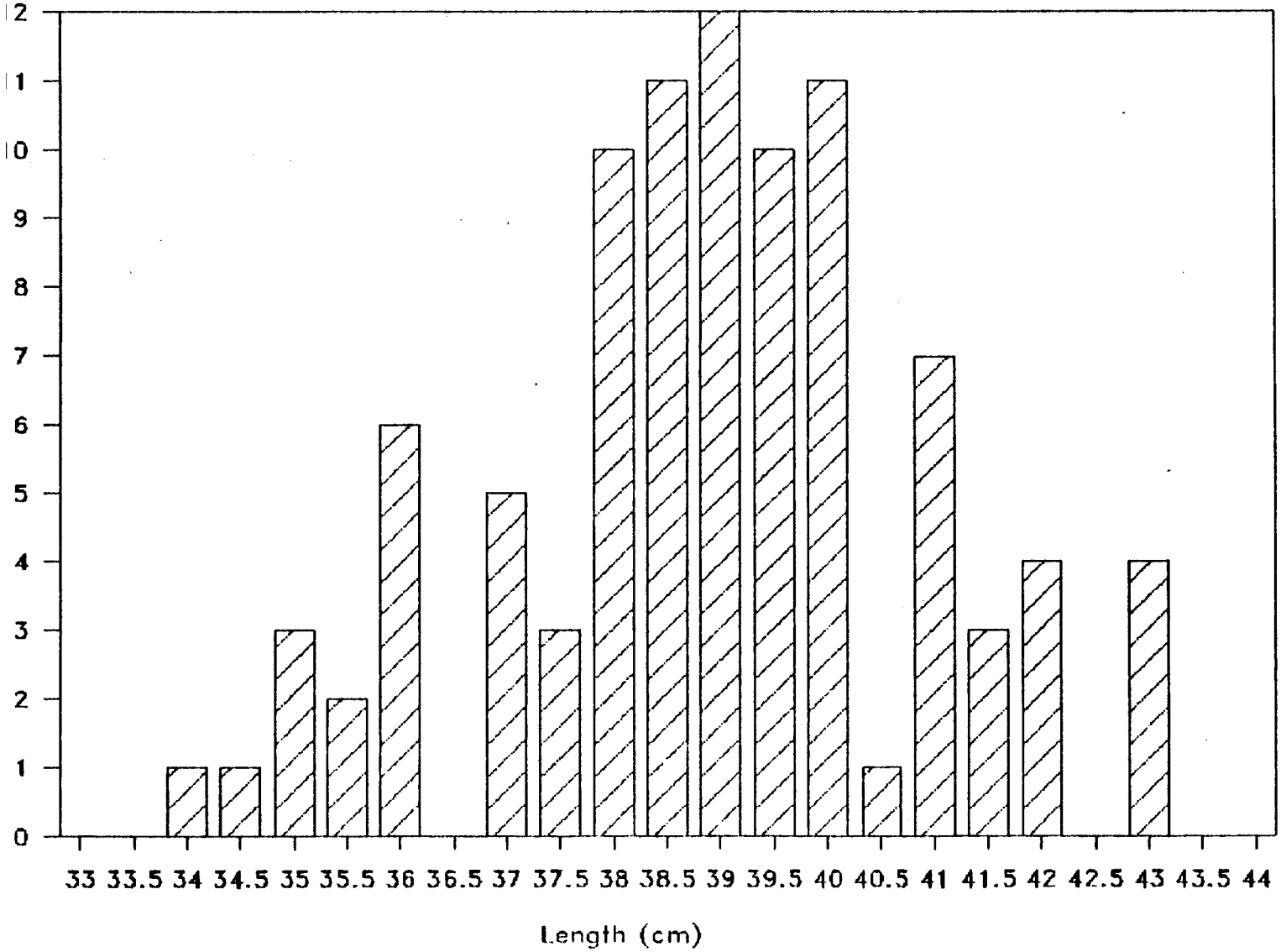

Figure 2. Length frequency of male kokanee trapped at Moose Creek, 1988.

CABINET GORGE HATCHERY

ANNUAL REPORT

Prepared by:

Ed Schriever, Fish Hatchery Superintendent II
Chuck Warren, Fish Hatchery Superintendent I

INTRODUCTION

The purpose of Cabinet Gorge Hatchery is to produce advanced stage late-spawning kokanee salmon fry for Lake Pend Oreille (Table 1). These fry are needed to mitigate for the loss of wild kokanee recruitment caused by hydroelectric power projects on the Pend Oreille watershed. The hatchery also controls timing of the release of these fish to coincide with the altered cycles of zooplankton blooms in the lake caused by Mysis shrimp.

FISH PRODUCTION

Survival of green eggs to feeding fry was estimated at 88.2% (1986-1987, 83.6%). Survival from first feeding to release was estimated at 92.3% (1986-1987, 90.8%), resulting in survival from green egg to release of 81.3% (1986-1987, 76%) (Table 2).

A total of 13,027,000 kokanee fry were produced at an average weight of 2.20 pounds per thousand, a total of 28,670 pounds produced. These fish gained 26,382 pounds from 26,411 pounds of feed, a conversion rate of 1:1 (Table 3).

Total operating expenses, less capital outlay, for Cabinet Gorge Hatchery during 1987-1988 was $165,827. This results in fish production costs of $5.78 per pound and $12.72 per thousand fish produced (Table 4).

Fish feed production costs were $.442 per pound and $1.26 per thousand.

FISH HEALTH

Fry

Kokanee fry experienced an episode of increased mortality during the 1987-1988 fish year. This increase in mortality was confined to a few raceways. The magnitude of mortality between raceways was great.

Pathological investigations detected a constriction between the pyloric and cardiac sections of the stomach, which was preventing passage of food into the pyloric region of the intestine (Hauck, personal communication).

This condition, coined as "plugged gut", was most probably a result of rapidly decreasing rearing water temperature. Mortality of this episode claimed an estimated loss of less than 22 of hatchery inventory.

The effective therapy for this condition was a treatment of Epsom salts at 3% of the diet for three days, then no feed for two days. This treatment was used to prevent possible outbreaks in additional raceways that showed early symptoms of "plugged gut", with good results.

Broodstock

Annual brood inspection of Sullivan Springs kokanee was negative for viral pathogens and BKD. These results are consistent with previous year's results from this source.

Brood inspection of adult kokanee trapped at Cabinet Gorge utilized the Indirect Fluorescent Antibody Test (IFAT) using ovarian fluid samples. A comparative diagnostic test of the tissue samples from the same 60-fish pool was done by the U.S. Fish and Wildlife Service using the Enzyme-Linked Immunosorbent Assay (ELISA) method.

Results of this brood inspection showed a low level presence of the BKD pathogen (Table 5) (Landin, personal communication). The IFAT technique is more sensitive than the Direct Fluorescent Antibody Test (DFAT) that has been used on previous year's testing (Landin, personal communication) and was used on the Sullivan Springs brood examination this year.

All tests for viral pathogens were negative.

WATER TEMPERATURE

Lower spring and upper well field water temperatures vary inversely with each other over a 12-month period (Figure 1). A mixture of these two water sources allowed incubation water, to be tempered to a range of 8.1°C to 10.8°C. Early rearing water was also tempered during feed training and maintained between 6.0 and 7.0°C (42.8 to 44.6°F) (Figure 2).

FISH TRAPPING

The Cabinet Gorge fish trap was in operation from October 20, 1987 to January 10, 1988. Kokanee began entering the trap on October 30, with the last kokanee trapped and spawned December 31, 1987. Trapping yielded a total of 4,437 late-run kokanee (43% females and 57% males) (Table 6). Prespawning mortality of females was 7.4% compared to 1986 figures of 21.7%. This reduction in prespawning mortality was attributed to reduced handling, prespawn sorting and segregation, and the use of tempered water from the completed lower springs expansion project.

SPAWNTAKING AND EGGS RECEIVED

Kokanee spawntaking began in early November and continued through early January. The spawning operations peaked in early December at Sullivan Springs and mid-November at Cabinet Gorge Hatchery (Figure 3).

A total of 16,015,000 green kokanee eggs were received at Cabinet Gorge Hatchery during the 1987-1988 production year. Of those, 605,632 were collected from 1,922 female kokanee at Cabinet Gorge Hatchery, and the remaining 15,409,368 were received from the Sullivan Springs trap (Figure 4).

SPAWNTAKING PROJECTIONS

From research estimates of hatchery fry survival to fall recruitment, estimates of year class strength can be quantified. Following the individual year classes through time with some assumed survival rates can predict year class strength for spawning escapement. This method is very crude and only reflects the potential egg take based on year class strength. However, it does provide basic trend information on how the rehabilitation effort is progressing. Projected egg take should be close to 30 million in 1991 (Table 7). Over 40 million eggs should be available in 1992.

This projection uses the following assumptions:

1. 50% survival from 0+ recruit to 1+.
2. 65% survival from 1+ to 2+.
3. 65% survival from 2+ to 3+.
4. 65% survival from 3+ to 4+.
5. 11% exploitation as 3+.
6. 11% exploitation as 4+.
7. 25% mature as 3+.
8. 75% mature as 4+.
9. 350 eggs per female s 3+.
10. 400 eggs per female as 4+.
11. 1:1 sex ratio.
12. all hatchery origin, Sullivan Springs adults return to Sullivan Springs.

Clark Fork River

1. 20% trapping efficieny on prehatched-released fish.
2. 50% trapping efficieny on nonmorpholined, hatchery-released fish (1986).
3. 80% trapping efficiency on morpholined, hatchery-released fish.

FISH MARKING

Five different release groups were marked individually (Table 8). The Clark Fork River release, Clark Fork River barge release, and the Sullivan Springs release had fin clip sample groups within the release groups. The barge, open north, and open south release groups were marked with Terramycin (TM100) fed at 5.5% of feed weight for 10 days. A total of 50,000 Clark Fork River-released fish were marked with a left ventral fin clip. 40,000 Sullivan Springs-released fish were marked with a adipose fin clip, and 40,000 of the Clark Fork River barge-released fish were mrked with a right ventral fin clip. An attempt to mark fish from a cross section of lots with a temperature-otolith mark was unsuccessful because of fluctuations in rerng temperatures.

The TM100 mark was used as a mass mark on the three release groups: open north, Clark Fork barge, and open south. The main purpose of this mrk was to provide a double check for an otolith mark that is laid down naturally at time of release.

The ventral clips versus the adipose clip will be used to estimate the rate of adult straying between the Clark Fork River returns and the Sullivan Springs returns. The left ventral versus the right ventral clip will be used to evaluate adult return rates of hatchery release versus barge release in the Clark Fork River.

FISH LIBERATIONS

During June 1988, 3,413,700 fish were liberated from Cabinet Gorge Hatchery into the Clark Fork River and 1,607,000 were released into the north end of Lake Pend Oreille near Warren Island. During July 1988, 8,006,300 were liberated from Cabinet Gorge Hatchery. Of these, 5,138,800 were released in Sullivan Springs, 1,297,000 were barged down the Clark Fork River and released in Pend Oreille Lake at the mouth of the Clark Fork River, and 1,570,500 were released into the south end of Pend Oreille Lake offshore from Bayview, Idaho (Table 9).

Kokanee in the Clark Fork River release and the Sullivan Springs release were imprinted with morpholine at 5 x 10^{-5} ppm for three days prior to release and during release.

Clark Fork River Barge

The fish in the Clark Fork River barge release were transported down river in two 6-foot diameter, circular tanks on a pontoon barge. Water depth was adjusted in the tanks according to maximum weight capacity of the barge and weight balance, front to rear. One tank held 1,010 gallons of water, and the other tank held 1,300 gallons of water. The barge was moored at a temporary dock constructed below Residence No. 1. Initial watering of the tanks was done using hatchery production water transferred through 240 feet of 1 1/2-inch PVC pipe that ran out of the hatchery building, down the bank of the river to the temporary dock. Fish were loaded into the tanks using the same pipe system. Excess water in the tanks drained over the top of the screened standpipe and was discharged through a drainpipe over the side of the barge.

River water temperature and olfactory tempering were accomplished using a pedestal-type sump pump. The pump was mounted to a frame on the deck of the barge with the impeller hanging in the river. This pump was powered by a portable generator on the barge. The pump delivered water via a spray bar to both tanks. Flow rate was approximately 10 gallons per minute per tank. The fish also received supplemental oxygen through diffusers in the tanks. Each tank had its own oxygen bottle and regulator. The tanks were covered with black plastic to reduce fish stress during transportation.

Fish were liberated from the tanks by removing the screen and drain standpipe and discharging fish and water out the drain line.

Loading densities in the tanks started very light at .084 pounds per gallon and were increased on consecutive trips in an attempt to determine tank capacity. Loading density reached a high of .15 pounds per gallon, with no ill effects to fish. Fish size was approximately 2 inches, and river water temperature was approximately 17.5°C (64°F).

Tanker Hauling

Both the open water releases and the Sullivan Springs release utilized the 10-wheel, 2,100-gallon Corps of Engineers tankers. Some modifications were made to the tankers for hauling these 2-inch fish. The agitators were not used and had to be completely closed off to prevent fish from getting stuck inside. The sight tubes for water displacement readings were removed as fish were getting inside them and suffocating. The lids were equipped with weather stripping for a tighter seal.

Loading densities of 2-inch fish in the tankers ranged from .25 to .46 pounds per gallon, with an average load of .36 pounds per gallon.

Open Water Releases

Open water releases were accomplished by driving a 10-wheel, 2,100-gallon tanker onto a work barge and pushed out into the lake with a tugboat. The open north release utilized a private barge that was hired from Cramer Construction, Hope, Idaho. The open south release utilized a barge that was donated for use from the Navy Base at Bayview. Tanker loads were tempered using a gas-powered, 2-inch, trash pump. Tempering took place during transportation out on the barge.

Sullivan Springs

Tanker access into Sullivan Springs is limited. Fish were planted above the bridge on the access road to the IDFG patrol cabin. The tankers were backed down the hill to the corner. Fish were piped using 60 feet of 8-inch rigid discharge hose and 20 feet of collapsible hose. The collapsible hose was attached in the middle of the hose assembly and functioned to slow the discharge velocity during planting. Two tankers made two trips per day.

It is recommended that prior to release date a tanker load of water be hauled to the site and be used to scour out a pool to be used during fish releases.

Other Species

Gerrard Rainbow

On May 12, 4,875 F1 wild Gerrard-strain Kamloops were transferred to Cabinet Gorge Hatchery from Mackay Hatchery. These fish were held in the adult holding ponds and acclimated to Cabinet Gorge water until June 15, when they were released into the Clark Fork River. Prior to release, these fish were all marked with a right maxillary clip and imprinted with morpholine at .00005 ppm for three days.

On March 25, 1988, 26,140 eyed Gerrard-strain Kamloops eggs were picked up from the Kootenai Trout Hatchery in Wardner, British Columbia, Canada. These eggs were from a broodstock (Fl) that was propagated from wild parents. Therefore, these are F2 wild fish. These eggs are from two egg takes and were a cross section of matings of 22 male fish and 22 female fish. Eggs from the earliest spawning were at 274 degree days during shipment and had begun hatching:

The eggs were disinfected in 1:150 buffered Argentyne for 10 minutes. This disinfection caused mortality of 1,022 sac fry. Fish were started on feed on April 15.

The production plan for these fish calls for half to be 6 inches long and half to be 12 inches long for a mid-June release. The lot was split on September 1, with one group averaging 3.8 inches and the other group averaging 2.65 inches on October 31.

Chinook Salmon

Cabinet Gorge Hatchery is responsible for the spawning of fall chinook salmon established in Lake Coeur d'Alene. Once the eggs have been eyed up at Cabinet Gorge Hatchery, they are shipped to Mackay Hatchery where they are hatched and reared until they are stocked back into Lake Coeur d'Alene. This year, a total of 42 females were spawned for a total 217,057 green eggs (Table 10). The total number of eyed eggs was 108,679 (50% eye-up), of which 89,179 were shipped to Mackay Hatchery. That left an excess of 19,500 eggs, which were discarded.

These eggs are held in isolation at the adult holding ponds during incubation. Ovarian fluid and tissue samples were sent to Eagle Lab. Results were negative for BKD and viral pathogens.

Brown Trout

Cabinet Gorge Hatchery maintained and operated a weir and fish trap on lower Twin Creek, a tributary to the Clark Fork River, from October 1 through December 22, 1987. The trap was placed in the culvert under the railroad tracks on private property owned by Ruen Farms.

The objective of this trap was to inventory and obtain eggs from wild brown trout that were reported to be using Twin Creek for spawning habitat. The progeny will be returned to Twin Creek in an attempt to enhance numbers of returning adult fish.

Three female brown trout yielded a total of 6,341 green eggs, an average of 2,114 eggs per female (Table 11). These eggs were taken to Clark Fork Hatchery for incubation and rearing.

An alternate method of fungal control for kokanee eggs was tested during 1987-1988 at Cabinet Gorge Hatchery. Approximately 1,050,000 green eggs from Sullivan Springs egg takes 16 and 17 were placed into upwelling incubators. Loading rates were 102,000 eggs per incubator. Three incubators were not treated with the usual 1:600 formalin treatments. Instead, the flow was adjusted up to a level so the eggs were at a point of just rolling. Evaluation of survival to hatch was compared to the incubators that were treated with formalin (control) (Table 12).

Table 1. Kokanee requested and produced.

Species & size	Production goal	Actual production	Percentage[a] of goal achieved
Kokanee fry	20,000,000	13,027,000	65

[a]Egg take was 61.52 of requirement for full production.

Table 2. Survival summary, kokanee salmon, Cabinet Gorge Hatchery, 1987-1988.

Lot no.	Number green eggs	Survival		
		Green egg to first feeding	Green egg to release	Feeding fry to release
SS1	2,465,815	.915	.867	.948
SS2	2,581,454	.867	.703	.811
SS3	2,473,751	.892	.838	.939
SS4	2,563,762	.897	.860	.959
SS5	2,774,189	.890	.802	.901
SS6	2,550,397	.842	.813	.966
CF1	393,442	.807	.778	.964
CF2	212,190	.888	.869	.988
Total	16,015,000	.882	.813	.922

Table 3. Kokanee production summary, Cabinet Gorge Hatchery, 1986-1987.

Lot no.	Number produced	Pounds produced	Pounds per 1,000	Feed fed	Weight gain	Conv.
SS1	2,166,963	5,131	2.37	4,735	4,730	1.00
SS2	1,825,924	4,060	2.22	4,034	3,690	1.09
SS3	2,071,936	4,665	2.25	4,159	4,308	.96
SS4	2,176,712	4,525	2.08	3,985	4,171	.96
SS5	2,180,489	4,608	2.11	4,167	4,367	.95
SS6	2,114,741	4,451	2.10	4,200	3,969	1.06
CF1	305,923	791	2.58	725	738	.98
CF2	184,312	439	2.38	406	409	.99
Total average	13,027,000	28,670	2.20	26,411	26,382	1.00

Table 4. Kokanee production costs at Cabinet Gorge Hatchery, 1987-1988.

Budget class	Dollars	Cost per lb.	Cost per 1,000
Personnel	68,899	2.40	5.29
Utilities	36,484	1.28	2.80
Government overhead	22,163	.77	1.70
Supplies	22,074	.77	1.69
Maintenance	6,656	.23	.51
Communication	4,182	.15	.32
Vehicle	3,569	.12	.27
Other	1,800	.06	.14
Total Operating	165,827	5.78	12.72

Table 5. Results of IFAT and ELISA tests for BKD for a 60 kokanee sampling at Cabinet Gorge Hatchery.

	IFAT	ELISA
No. positive	1	5
Percent positive	1.67%	8.33%
No. questionably positive	0	12
Percent questionably positive	0	20
Total no. positive & questionably positive	1	17
Total percent positive & questionably positive	1.67%	28.33%

*Source: Eagle Fish Health Lab.

Table 6. Late-run kokanee trapping at Cabinet Gorge Hatchery, 1987-1988.

Month	Total 1987	Total (1986)	Males 1987	Males (1986)	Females 1987	Females (1986)	Pre spawning female mortality 1987	Pre spawning female mortality (1986)
Nov	3,218	(1,950)	1,942	(1,169)	1,276	(781)	18	(143)
Dec	1,219	(935)	573	(406)	646	(529)	125	(143)
Jan	0	(66)	0	(13)	0	(53)	0	(10)
Total	4,437	(2,951)	2,515	(1,588)	1,922	(1,363)	143	(296)

Table 7. Projected potential egg take, by location, in Lake Pend Oreille, 1989-1992.

	1989	1990	1991	1992
Cabinet Gorge				
Age 3+	350,000	2,520,000	8,680,000	N/A
Age 4+	400,000	980,000	5,120,000	16,000,000
Total	750,000	3,500,000	13,800,000	16,000,000 +
Sullivan Springs				
Age 3+	385,000	2,800,000	12,600,000	N/A
Age 4+	5,480,000	800,000	4,120,000	25,000,000
Total	5,865,000	3,600,000	16,720,000	25,000,000 +
Grand total	6,615,000	7,100,000	30,520,000	41,000,000 +

Table 8. Differential marks applied to different release groups of kokanee fry produced at Cabinet Gorge Hatchery, 1988.

Release date	Release site	Number fish released	Fin clips			
			Ventral			
			TM100	Left	Right	Adipose
June 15	CFR-CGH	3,413,700				X
June 25	Open North	1,607,000	X			
July 5-9	Barge CFR	1,297,000	X		X	
July 11-	SS	5,138,000				X
July 27	Open South	1,570,500	X			

Table 9. Late-kokanee liberation from Cabinet Gorge Hatchery, July 1988.

Date	Release site	# Fish released	Total pounds	Length (inche	No./ lb.
	Clark Fork River				
June 15	Cabinet Hatchery	3,413,70	8,453	2.0	403
July 5-9	Clark Fork barge to Lake Pend Oreille	1,297,00 0	2,718	1.9	479
Subtotal --	Clark Fork River	4,710,70 0	11,171	1.98	429
July 11-14	Sullivan Springs	5,138,80 0	10,947	1.9	460
Subtotal --	Sullivan Springs	5,138,80 0	10,947	1.93	460
	Pend Oreille Lake				
June 25	Open water, North	1,607,000	2,981	1.8	535
July 26	Open water, South	1,570,500	3,571	2.0	435
Subtotal --	Pend Oreille Lake	3,177,500	6,552	1.90	485
TOTAL	Pend Oreille drainage	13,027,000	28,670	1.93	465

Date	Eggs/ ml	Total ml	Total eggs	Number females	Eggs/ female	Number males
9/20	3.5	4,502	15,750	4	3,937.5	6
9/23	3.76	2,250	8,460	2	4,230	4
9/27	3.58	2,500	8,950	2	4.475	4
9/30	2.94	1,600	4,700	1	4.700	2
10/2	2.99	3,500	10,464	2	5,232	3
10/5	3.27	10,600	34,662	7	4,951.7	5
10/7	3.92	6,650	20,083	4	5,020.7	5
10/12	3.22	35,400	113,988	20	5,699.4	15
Total/ average	3.24	67,000	217,057	42	5,168	44

Table 11. Summary of brown trout spawning at Twin Creek trap, 1987.

Date	# females	# males	Eggs/ml	Total ml	Total eggs
12/4	1	1	10.5	124.9	1,311
12/10	1	1	10.4	356	3,880
12/20	1	1	13.7	84	1,150
Total	3	3	11.2	564.9	6,341

Table 12. Results of alternative fungus control experiment at Cabinet Gorge Hatchery, 1988.

	Formalin control			Roll test		
Egg take	Green eggs	Sac fry	Percen surviva	Green eggs	Sac fry	Percent survival
16	245,606	206,129	83.9	120,713	107,134	88.8
16	247,358	215,048	86.9	121,994	110,397	90.5
17	211,939	173,299	81.8	120,330	91,804	76.3
Total/ average	704,903	594,476	84.3	363,037	309,335	85.2

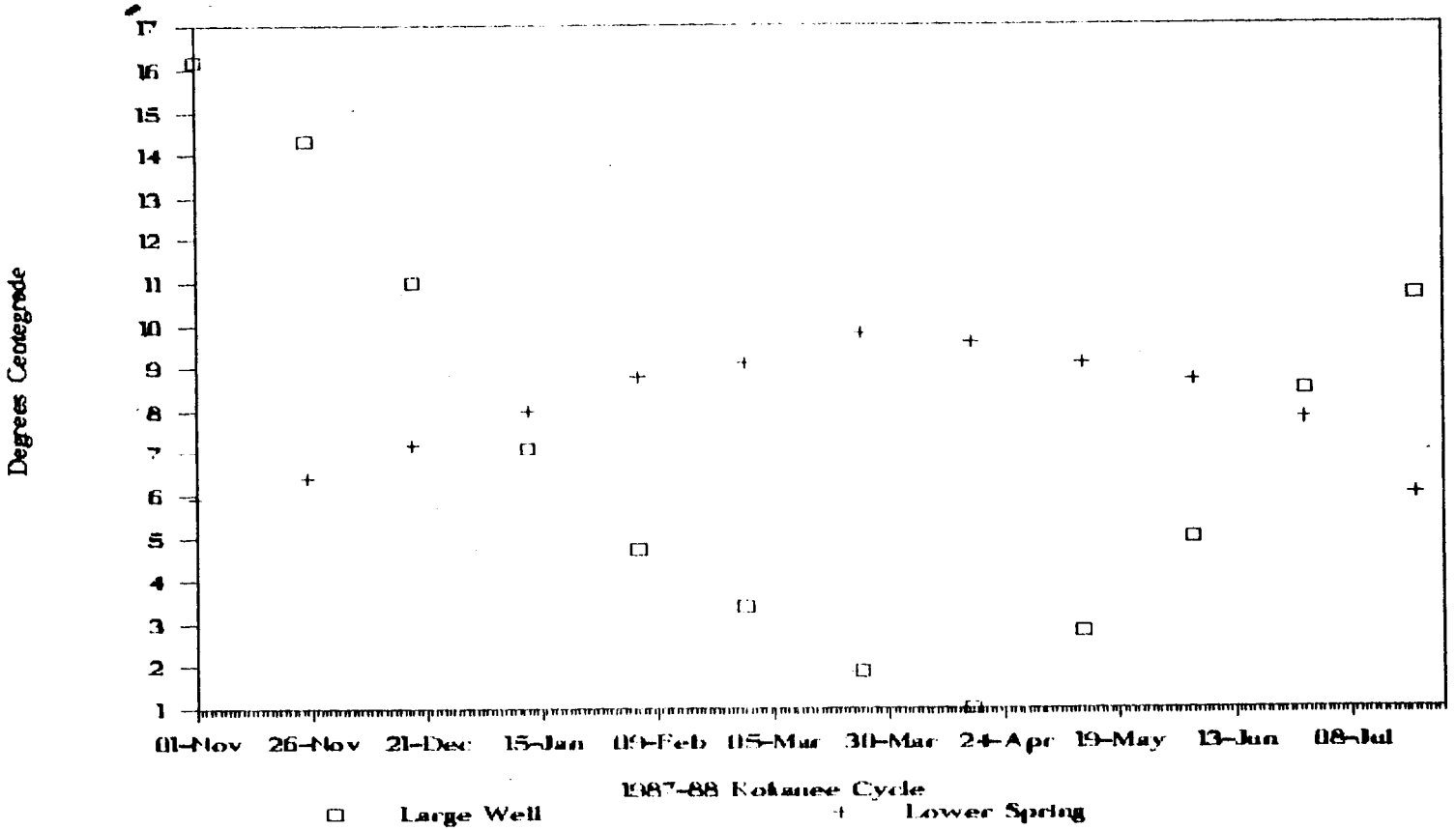

Figure 1. Temperature profile of different water sources at Cabinet Gorge Hatchery, 1987-1988.

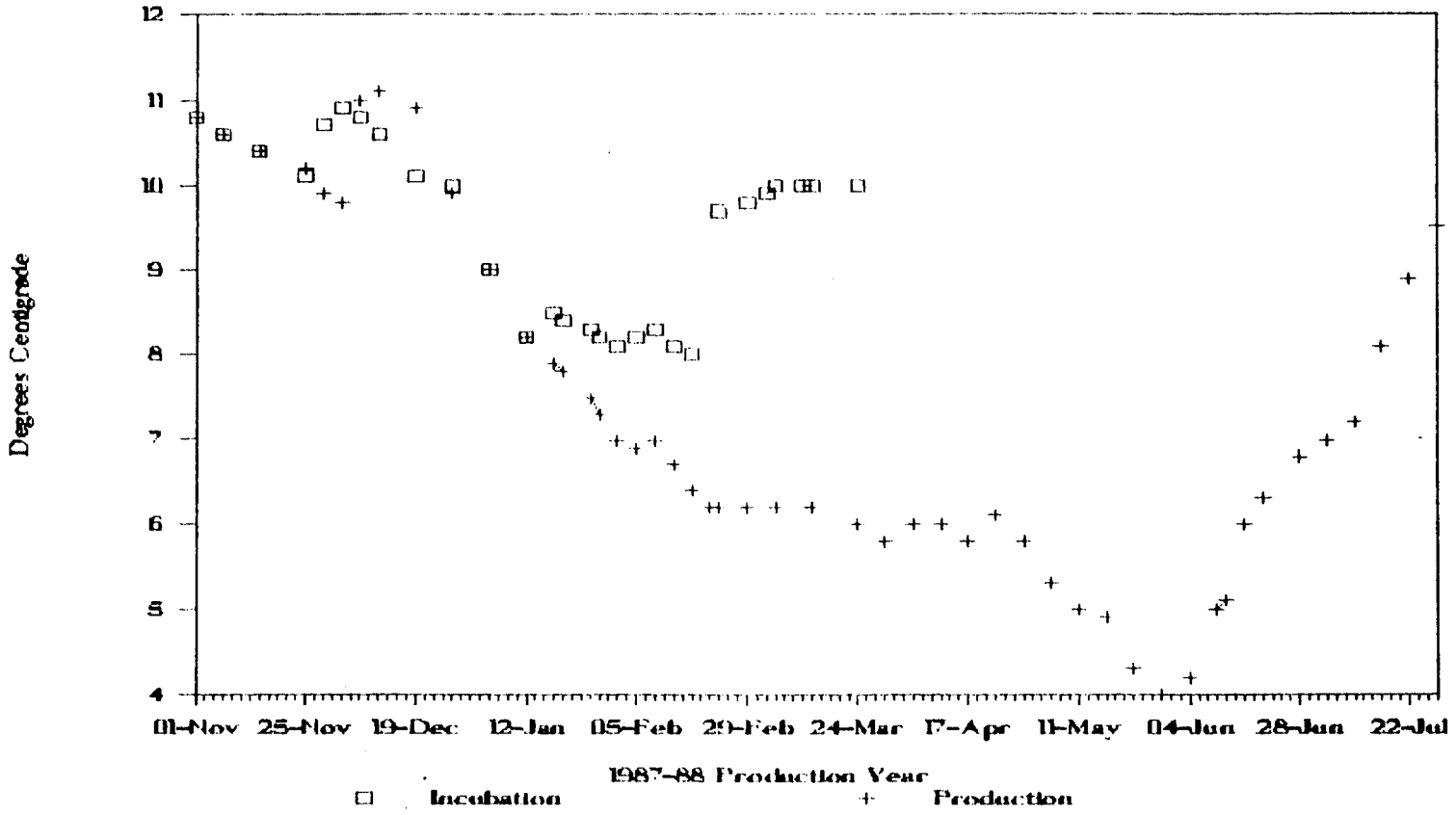

Figure 2. Temperature profile of water used in fish production at Cabinet Gorge Hatchery, 1987-1988.

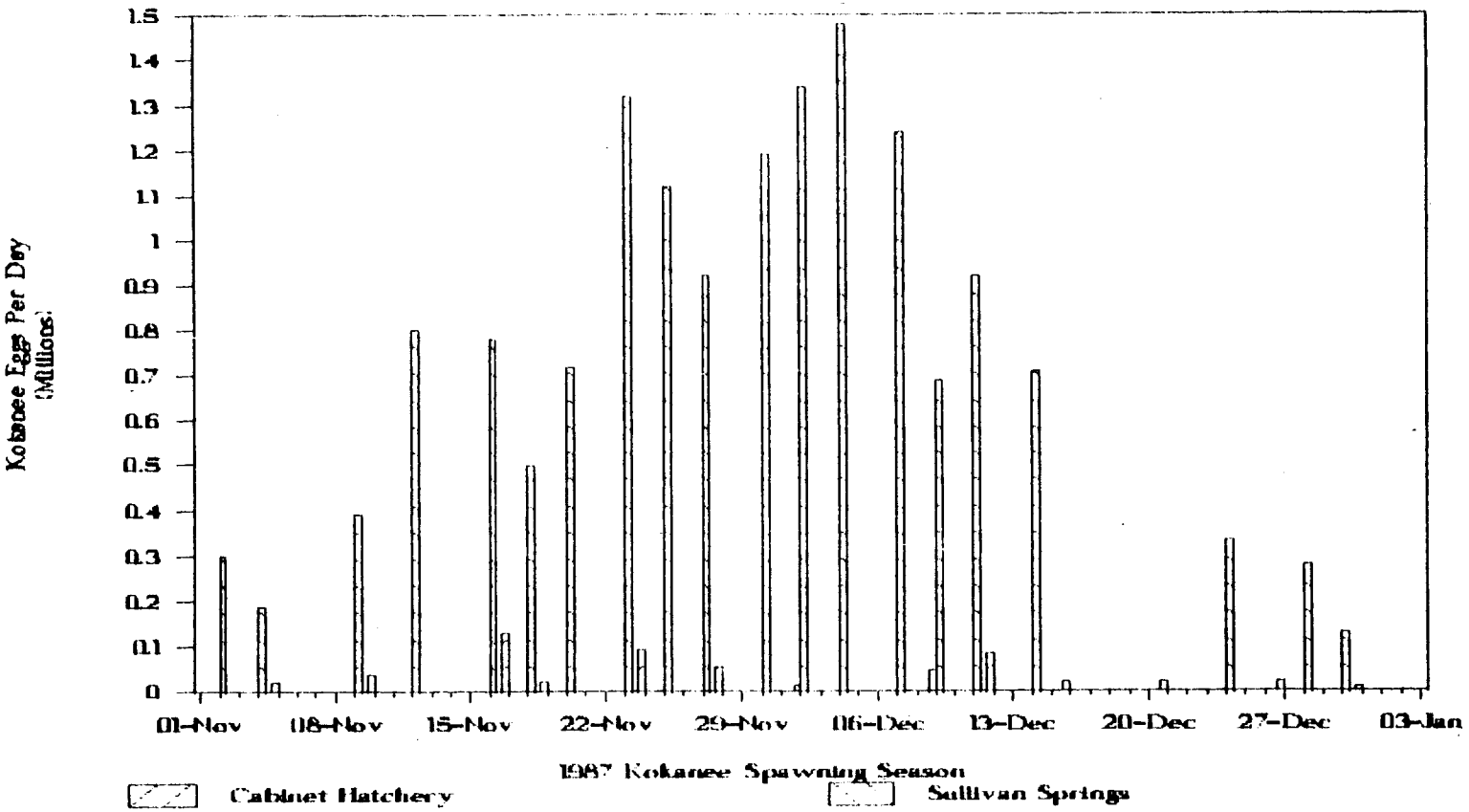

Figure 3. Kokanee egg take by date and location, Cabinet Gorge Hatchery, 1987-1988.

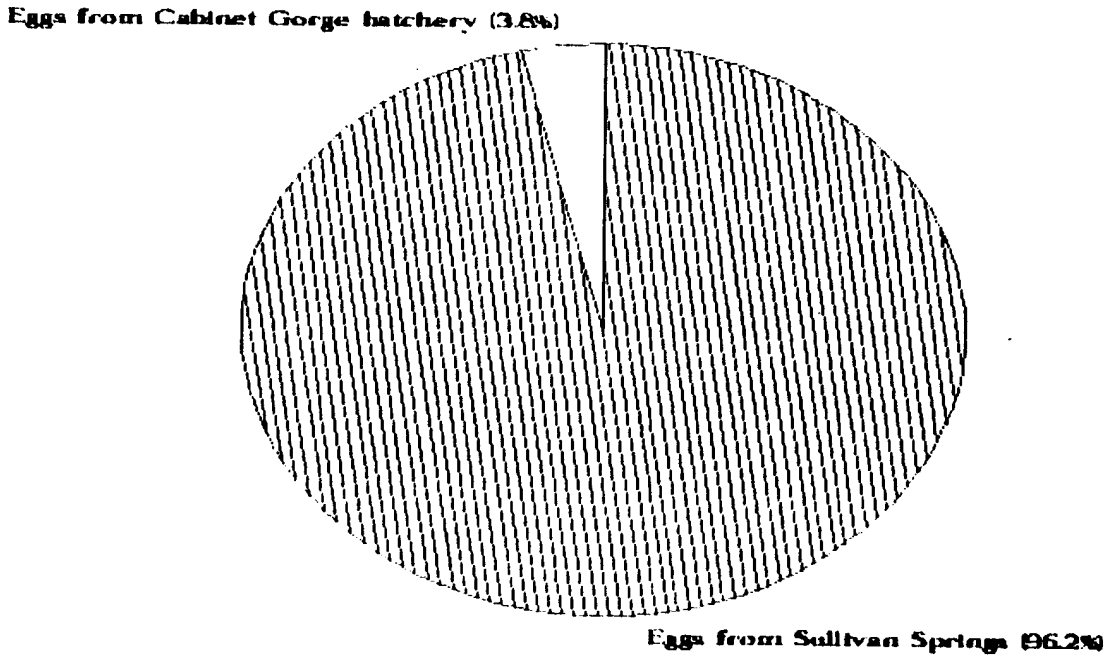

Figure 4. Percent of eggs taken from different sources, Cabinet Gorge Hatchery, 1987-1988.

CLARK FORK HATCHERY

ANNUAL REPORT

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INTRODUCTION

Clark Fork Hatchery is a license-funded resident species hatchery located 1.5 miles northwest of Clark Fork, Idaho. This past year, Clark Fork Hatchery produced over 4.5 million fish. Westslope cutthroat trout amounted to 2.07 million of these, with kokanee close behind with 2.02 million fish produced. Kamloops, brown trout, brook trout and grayling were also produced in smaller numbers (Table 1).

HATCHERY IMPROVEMENTS

There were no major renovations undertaken at Clark Fork Hatchery this past year. There is a ground water study funded and scheduled for October 1988. A seismic crew consisting of geophysicists will be on site to conduct the tests to determine availability, depth and location of groundwater.

Minor improvements conducted over the year consisted of the installation of a large new entrance sign and a visitor center.

Proposed improvements for the next year are to expand the visitor center (e.g., enlarged photos, displays), development of a display pond containing various species reared at Clark Fork and to develop a ventilated chemical storage room.

PUBLIC RELATIONS

There were over 2,000 visitors touring the hatchery this past year, along with eight school tours conducted in the spring.

The Bonner News Digest published three articles concerning the stocking of Kamloops into Spring Creek and the cutthroat plants into Mirror Lake. A catchable rainbow plant was made in conjunction with an aquatic education class at Round Lake State Park. The kokanee releases into Priest Lake were highly publicized, and a large audience was present

to watch the releases. The Daily Bee published two articles concerning the mountain lake plants.' One discussed the assistance provided by the Boundary Backpackers and the other discussed the helicopter planting assistance provided by WI Forest Products.

A visitor center was started and is being expanded, hopefully to be completed by the spring tourist season. It contains local area maps, fishing and hunting regulations, Project Wild brochures and fish identification charts. There will be a display pond with the various species of fish available for viewing and a feed vending machine. An article is going to be written for the local chamber of commerce publication, and a handout brochure is planned.

FISH PRODUCTION

Size of fish planted by month is shown in Table 2. Environmental conditions for rapid growth do not exist at the Clark Fork Hatchery. The water temperature ranges from 37°F during the winter to the upper 50s in summer, with the mean at around 44°F. Table 3 lists fish by species and average daily growth to release on November 30.

Egg losses for cutthroat may be affected by disinfecting with Argentyne. After disinfection, eggs that previously looked good started turning white. This spring, experiments will be carried out to see if survival can be improved.

FISH HEALTH

On August 23, fish samples were sent to the Eagle Lab for diagnosis as higher-than-normal mortality was being experienced in one lot of westslope cutthroat fry. IPN was suspected and later confirmed. The viral outbreak was contained to just two vats in the hatchery building and resulted in the loss of approximately 40,000 fry.

There were no other major disease problems encountered during the year. BKD is present, and a few fish were lost due to the disease, but it was not a major mortality factor.

Rangens soft-moist feed is preferred for all species reared at Clark Fork Hatchery. Growth rates were better compared to other feed, and the fish appear healthier. There was no incidence of sunburn this year. The Eagle Lab compiled a list of fish examinations and results for Clark Fork Hatchery for the past year (Table 4).

RELEASE STRATEGIES

Fish planted from Clark Fork Hatchery are loaded into 46 to 48ºF water. As planting trips are made, the water warms up in the truck. Tank temperatures range from 46°F in May to 68°F in July. Upon arrival at release sites, all fish are tempered to within 5°F of the receiving water before planting.

Catchable Rainbow

Rainbow are planted where lake or stream access is available. Fish may be unloaded in one or several places depending on receiving water. This year's catchables ranged from 8.3 to 9.8 inches in length. Releases are accomplished as early in the year as possible to meet management goals and still provide the "best" environmental conditions. Water temperatures in northern Idaho range from 42°F in March to 74°F in July. Catchables are not planted in lowland lakes from mid-July through August because water temperatures are too high.

Cutthroat Trout

Most cutthroat trout reared at Clark Fork Hatchery are released as fry or two-year-old fingerlings. Students from the University of Idaho planted over 900,000, 0.9-inch, feeding fry in tributaries to Priest Lake. These fry were placed in buckets of water and spread in sections of the streams at about 10 fish per square meter. According to their research, that was the optimum carrying capacity. These fish were fed for nearly two weeks before release.

Cutthroat are planted as fry in mountain lakes. Horses, backpacks and an occasional helicopter are the means of transportation. The fry are put in insulated milk bags with water and oxygen. The package includes blue ice to keep temperatures down. Upon arrival at the lake, the plastic bag is placed in the water to allow tempering. When temperatures are equal, the 1.0-inch fish are released near shore where cover and food are available. Mountain lake plants are made in July and August when trails are passable and fish food is most plentiful. Water temperatures are usually in the upper 50 to lower 60°F range.

Two-year-old cutthroat are planted in lowland lakes or their tributaries. Planting sites are chosen by access points. These fingerlings are released at 4.5 to 5.0 inches. Water temperatures range from 59ºF to 69ºF.

Kokanee

Most of the kokanee are planted in Kalispell and Granite creeks, tributaries to Priest Lake. Planting sites are chosen by access. These 1.5-inch fry are planted in the evening about 300 yards from the lake. These late-evening tributary plants cut down on predation and allow time for imprinting. Kokanee are planted in late July or early August when optimum lake conditions occur. The water was 61°F in Kalispell Creek and 60°F in Granite Creek.

The rest of the kokanee are planted in lowland lakes during July or August at about 1.7 inches. These releases are made in waters with temperatures from 70°F to 74°F. Plant sites are determined by access.

SPECIAL PROJECTS

In late April 1988, two Lake Merwin traps were set at the northern end of Upper Priest Lake in an attempt to capture and spawn westslope cutthroat to develop a "clean and pure" strain of broodstock for future stocking needs. One trap was set just north of Trapper Creek and the other was southeast of the mouth of Priest River. A picket weir was set in Trapper Creek, but flow fluctuations made it impossible to hold the trap in place. Over 100 cutthroat were captured, but none were mature. Many bull trout, kokanee and whitefish were also captured and released. It was determined that this method of upgrading the broodstock was not feasible, and other alternatives will be attempted.

Kamloops broodstock collection on the Clark Fork River was attempted this year by hook and line. There were 24 fish captured, with only 2 mortalities. Of these fish, only seven were females. There were approximately 25,000 eggs taken for rearing and release in Spring Creek in May of 1988.

Table 1. Fish requested and produced at Clark Fork Hatchery, 1988.

Species and size	Production goal	Actual goal	Percentage of goal achieved
Rainbow (R4) 810	19,000	119,703	101
Cutthroat (C2) 2-3	100,000	139,313	139
Cutthroat (C2) 1	962,225	947,698	98
Kamloop (K2) 2-3	20,000	11,638	58
Kamloop (K2) 1, 2-3	331,250	243,500	74
Kokanee (KL) 1	2,100,000	2,023,321	96
Brown (BN) 1	102,000	115,601	113
Brook (BK) 1	21,000	36,484	173
Grayling (GR) 1	6,000	5,505	92
Golden (GN) 1	1,000	0	0

Table 2. Size of fish planted (inches) from Clark Fork Hatchery in 1988.

Species	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov
Catchable rainbow	8.2	8.2	9.2	9.3		9.4	9.6		
Clark Fork cutthroat					.92[a]	.91[a]			
						8.8[d]	.97[b]	1.1[c]	
Fish Lake cutthroat			4.6	4.7	4.9	.99[c]	1.2[c]		
Spring Creek kamloops		3.0							
Skanes kamloop						2.6	2.6		
Kokanee					1.7				
Plymouth Rock browns				2.1	2.3				
Twin Creek browns									2.5
Henrys Lake brook					1.9				
Grayling							1.2		

[a]fed for 1 to 2 weeks
[b]fed for 1 to 2 months
[c]fed for 2 to 3 months
[d]surplus brood stock

Table 3. Daily average fish growth.

Source	Species*	Average daily growth inches	Month ending
Skanes Hatchery	K1	.0162	7
Spring Creek	K2	.0100	7
Ennis Hatchery	K2	.0096	7
Fish Lake stock (Clark Fork Hatchery)	C2	.0099	11
Clark Fork stock (Clark Fork Hatchery)	•C2	.0084	11
Plymouth Rock	BN	.0096	7
Twin Creek	BN (wild)	.0076	7
Henrys Lake	BK	.0093	7
Coeur d'Alene Lake	KL	.0066	7
Sullivan Springs	KL	.0066	7

* K1 Kamloops, domestic
K2 Kamloops, wild
C2 westslope cutthroat
BN brown trout
BK brook trout
KL kokanee

Table 4. Fish health report for Clark Fork hatchery, 1988.

Date	Accession	Lot/species	Diagnosis	Remarks
09-28-87	87-135	Brood Wolf Lodge' (CdA KL)	Negative for disease agents	Inspection negative for viral path.
11-18-87	87-135	Wild Wolf Lodge (CdA KL)	Negative for disease agents	Brood insp. negative for viral path.
04-25-88	88-54	83 Gerrard Rb (K2)	Negative for disease agents	Brood insp. negative for viral path. & BKD agent
06-08-88	8874	Brood Clark Fork (C2)	Negative for disease	Annual insp. negative for viral path., BKD agent, & Myxobolus cerebalis
06-08-88	88-75	87 Fish Lake (C2)	BKD	Annual insp. negative for viral path. Some fish with BKD agent were asymptomatic, others were symptomatic carriers
08-23-88	88-116	88 Fish Lake	IPN	Clinical case

A P P E N D I C E S

Appendix A. Eggs or fish received at Clark Fork Hatchery, 1987-1988.

Species/ strain	Date received	Source	Number	Percent hatch	Destination	Release date	Expected yield
Kokanee KL	11,12-87	Sullivan Springs	1,240,000	75	Priest Lake	7-88	1,000,000
Kokanee KL	11,12-87	Coeur d'Alene L.	1,335,000	87	Priest Lake	7-88	1,100,000
Brown BN	12-87	Plymouth Rock	140,180	95	Region 1	6-88	120,000
Brown BN	12-87	Twin Creek	6,341	71	Twin Creek	10-88	3,500
Kamloops K2	4-88	Spring Creek	25,000	72	Spring Creek	5-89	15,000
Kamloops KM	2-88	Ennis NFH	500,000	60	Hayden Lake	2-89	200,000
Kamloops K1	2-88	Skanes	30,000	95	Mtn. Lake	7-88	20,000
Brook BK	11-87	Henrys Lake	63,000	68	Region 1	6-88	36,000
Cutthroat	5,6-88	broodstock	1,079,185	48	Mtn. Lake	8-88	1,100,000
Cutthroat Clark Fork	5,6-88	broodstock	1,940,160	56	Priest Lake	9-88	1,100,000
Rainbow R4	2-7,88	American Falls	130,061	--	Region 1	1988	120,000
Grayling GR	8-88	Ashton	13,000	--	Mtn. lake	9-88	11,000

Appendix B. Spawning operations at Clark Fork Hatchery, 1987-1988.

Species/ strain	Number	Eggs/ female	Total eggs	Destination/ date	Expected yield	Cost
Kokanee KL Sullivan Spr.	40,807	408	16,649,417	Pend Oreille Lake 7-88	13,000,000	$6,000
Cutthroat C2 Fish Lake	1,924	560	1,079,185	Hayden Lake, Mtn. Lakes 1988-89	500,000	$5,900
Cutthroat C2 Clark Fork	6,919	280	1,940,160	Priest Lake 1988	1,100,000	included above
Kamloops K2	5	5,000	25,000	Spring Creed 1989	15,000	$1,000

Appendix C. Fish redistribution and cost.

Species/strain	Source	Destination	Cost	Cost/fish
Rainbow R4 8-10″	American Falls	Region 1	$8,400	$.07
Grayling GR 1″	Aston	Parker. Long Mt., Smith L.	$ 260	$.05

Appendix D. Survival and cost of fish reared at Clark Fork Hatchery, 10-1-87 to 9-30-88.

Strain/species/size	Percent survival from egg previous fish year to plant	Cost	Cost/fish	Comments
Cutthroat C2 2-3″	96	$58,350	$ .11	Includes fish carried Over to 1989
Cutthroat C2 1″	47	$41,679	$ .03	Includes fish carried Over to 1989
Kamloops K2 2-3″	84	$ 714	$ .06	
Kamloops K2 1″	70	$ 119	$.007	
Kamloops KM 2-3″	44	$5,954	$ .03	Duncan River kamloops
Kamloops K1 2-3″	61	$ 714	$ .04	
Brown BN 1″	82	$ 1,190	$ .01	Domestic browns
Brown BN 1″	59	$ 179	$ .05	Twin Creek browns
Brooks BK 1″	58	$ 238	$.006	Henrys Lake brooks
Kokanee KL 1″	79	$9,330	$.005	

Appendix E. Fry production at Clark Fork Hatchery, 1987-1988.

Species/strain	Source	Number received	Number yielded	Destination and date
Kokanee KL	Sullivan Springs	940,000	933,382	Priest Lake 7-88
Kokanee KL	Coeur d'Alene	1,161,450	1,089,939	Priest Lake 7-88
Cutthroat C2 Fish Lake/Clark Fork	Broodstock	1,604,497	947,698	Priest Lake, Mtn. Lakes 7-88
Brown BN wild	Twin Creek	4,502	477,233 3,783	fingerling 6-89 broodstock 6-90 Twin Creek 10-89
Brown BN domestic	Plymouth Rock	133,171	115,601	Region 1 7-88
Brook BK	Henrys Lake	42,840	36,484	Mtn. Lakes 8-88
Kamloops KM	Ennis NFH	300,000	219,000	Hayden Lake 2-89
Duncan River Kamloops K2	Spring Creek	18,000	17,410	Spring Cr. 5-89
Kamloops K1	Skanes Hatchery	28,500	18,441	Mtn. Lakes 8-88

Appendix F. Fingerling production at Clark Fork Hatchery, 1987-1988.

Species strain	Source	Number received	Number received	Destination and date
Cutthroat C2	held over	157,849	139,313 12,592	Hayden, Mirror L. 6-88 broodstock
Cutthroat C2	held over	394,219	--	Region 1 6-89 broodstock
Kamloops K2	held over	13,865	11,638	Spring Creek 5-88

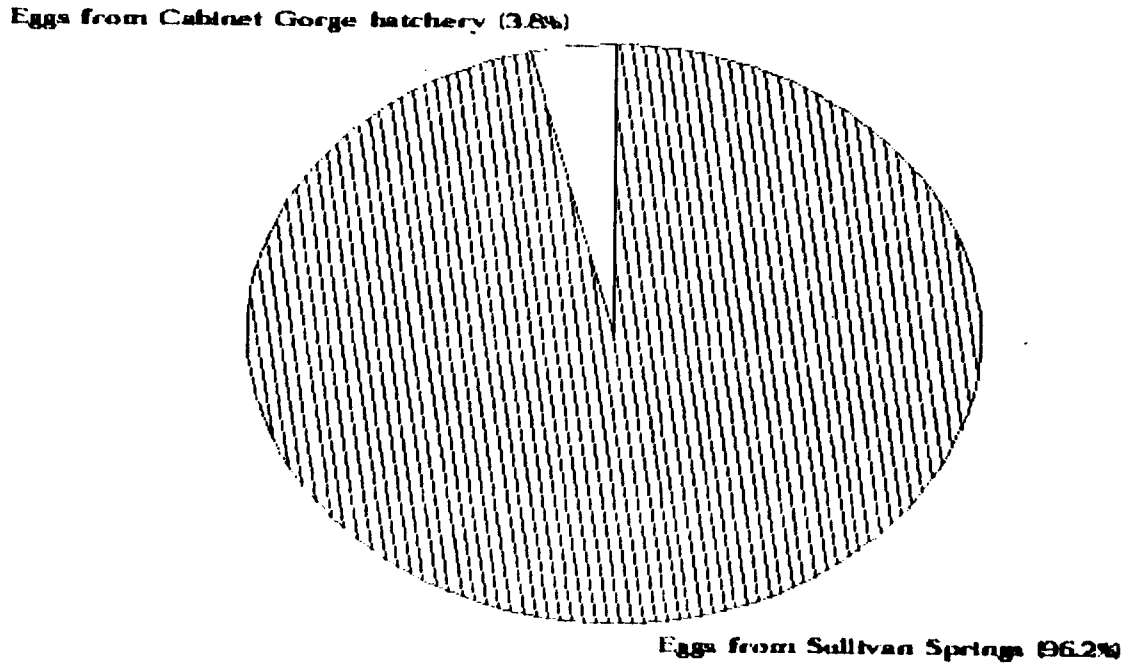

Figure 4. Percent of eggs taken from different sources, Cabinet Gorge Hatchery, 1987-1988.

GRACE HATCHERY

ANNUAL REPORT

Prepared by:

Bruce C. Thompson, Fish Hatchery Superintendent II
Doug Burton, Fish Hatchery Superintendent I
Doug Engemann, Fish Culturist

INTRODUCTION

Grace Hatchery produced a total of 875,000 fish (138,000 pounds) during the past year. Of these, 291,000 were 9-inch plus rainbow trout, 229,000 were 3- to 6-inch rainbow, and 355,000 were 6- to 7-inch Bear Lake cutthroat (Table 1).

Two Bear Lake cutthroat traps were operated during the year. One was in place on the Little Blackfoot River (a tributary of Blackfoot Reservoir), and the other was installed on St. Charles Creek (an Idaho tributary to Bear Lake).

HATCHERY IMPROVEMENTS

Grace Hatchery completed a number of improvements this year. A visitor information booth, with departmental brochures and posters, was constructed next to the hatchery picnic area. Highly visible directional and entrance signs were put up along the highway and county road to help guide visitors to the hatchery. Pole fencing was built and installed around the main spring supply pond and along the hatchery borders to keep livestock out, ensure visitor safety and control, and improve the overall aesthetics of the facility. All of the hatchery raceway screening was converted from hardware cloth to long-lasting perforated aluminum plating. A new submersible fish pump with a dewatering tower was purchased in April to facilitate fish loading. A phone-modem computer system was installed in mid-September.

The Bureau of Engineering's construction crew spent most of the month of November at Grace Hatchery. They installed a new domestic water supply line to the residences. In the process, they built an improved access road to the main spring supply pond. The crew, with some assistance from hatchery personnel, repaired the broken hatchery water supply line and shut-off valve, which allowed full utilization of the hatchery building. The crew also graded and recindered the entire driveway area around the large raceways, the hatchery buildings, and the recently excavated area surrounding the newly constructed small raceways.

Improvements to the hatchery residences included: (1) a new electric range top and hood were installed in Residence No. 1, (2) a new electric water heater was purchased for Residence No. 3, and (3) the old oil furnace in Residence No. 3 was found to be leaking fumes, was too dangerous to use, and was deemed too expensive to repair. It was replaced with a new, more efficient propane system in September, 1988.

FISH HEALTH

Bacterial gill disease was encountered in January and September of 1988. Both times it was brought on by heavy siltation of the water supply: once due to excavation work, the other due to livestock in the main spring (above the pond). The outbreaks were successfully treated with one-hour drip treatments of Cutrine followed by 1 to 2 ppm Benzalkonium Chloride for a three-day period. In September, an infestation of Hexamita was discovered in the Bear Lake cutthroat fry received from Utah's White Rocks State Hatchery. A three-day, 3% Epsom salt feed treatment was administered, and the pathogen level was significantly reduced.

In early June, Eagle Lab fish health personnel visited the hatchery and examined all the Bear Lake cutthroat on station. Viral samples were taken from a limited number of "wild" brood fish currently being spawned at the Little Blackfoot trapping site. Later in the month, a large number of brood fish became available, and tissue samples were collected by hatchery and regional personnel and sent to the Eagle Fish Health Laboratory for disease analysis. All results came back negative (Table 2).

PUBLIC RELATIONS

During the past year, hatchery visitation was estimated at around 5,000 people. In addition to regular visitors, hatchery personnel conducted organized group tours of the facility to approximately 500 students, scout groups, other youth organizations, and interested adult groups. A tour was also provided to the Regional Forest Service and Fish and Game coordination group. Another 500 people (310 children and 150 accompanying adults, plus onlookers) came for the Free Fishing Day opening of the hatchery settling pond. The pond was opened to fishing for children under 13 and handicapped individuals from the hours of 7:00 a.m. to 7:00 p.m. on June 11, 1988. One thousand one hundred and twenty fish were caught, with the two largest fish taken weighing 5 pounds each (a rainbow and a Bear Lake cutthroat).

Hatchery personnel again traveled to area schools to give slide presentations on current hatchery operations and Department programs. Personnel also gave a hatchery slideshow-talk to fellow employees at the Department's In-Service Training School held in Boise this year. Two local newspapers were contacted, and feature articles were written about the extensive Bear Lake cutthroat fin-clipping operation (355,000 fish were adipose clipped by five people in seven days). The Department's

Idaho Wildlife television crew also did a feature on the Bear Lake cutthroat program. Pictures taken by hatchery personnel appeared in the July-August issue of Idaho Fish and Game News. The assistant hatchery manager participated in the director's radio call-in talk show and discussed the strides the hatchery has made in fish production and public relations.

FISH PRODUCTION

Most of the fish at Grace Hatchery are produced from eyed eggs received from the State of Utah, Division of Natural Resources, Egan Hatchery located in Bicknell, Utah (Table 3). In addition, green Bear Lake cutthroat eggs are obtained from the spawntaking operation on the Little Blackfoot River. Egg quality has been low at Little Blackfoot, and adult returns have been unpredictable.

Green eggs are incubated in vertical-flow incubators until eye-up stage is achieved (350 TUs). Dead eggs are then electronically and manually picked out, and the live eggs are placed in PVC upwell-type incubators. All eyed eggs are put in upwelling incubators set up in hatchery vats until the fry have hatched (+200 TUs) and all but used up their egg sacs (+500 TUs). At button-up stage, they are all transferred into the vats for feeding and rearing.

Up to this point, both species (Bear Lake cutthroat and rainbow) are handled in the same fashion. Survival from eyed egg to swim-up is normally between 90 and 95%. From here, Bear Lake cutthroat require more specialized cultural techniques for successful rearing. This species has proven to do better on a semi-moist diet as opposed to a dry diet. Throughout rearing, the fish appear to be very sensitive to light intensities and photo period. This is especially important in the early rearing stages, and hatchery windows are covered. Bear Lake cutthroat are kept inside the hatchery building until they are about three inches long. At this time, they are gradually acclimated to more natural light in preparation for moving them to the outside ponds. The fish are transferred to the new small raceways from the vats with a 2-inch PVC pipeline. This is done to minimize moving stress on the fish. Initial loading density of these ponds is around .35 DI (or 1.05 pounds per cubic foot). This is a very critical factor in cutthroat trout rearing. If loaded too light, the fish have the tendency to run from the feed. It usually takes about two to three weeks before the cutthroat will settle down from this experience and get back on feed again. When any type of major stress occurs in a given month, the feed conversion rates will rise by about half a pound, and the daily length increase for that month will decrease by .006 to .008 inches. The following month, the fish are back on feed, and normal monthly feed conversions (1.0 to 1.2:1) and daily length increases (.017 to .021 inches) are encountered. For this reason, handling of Bear Lake cutthroat is kept to an absolute minimum. At around 5 inches, the cutthroat are fin clipped and thinned out one more time before planting. Afterward, the fish again go off feed for about two to three weeks. The use of raceway baffles, pond covers, and demand feeders should be future experiment priorities in continuing to refine species-specific cultural techniques at Grace Hatchery.

Rainbow strain evaluations have not been conducted at this facility due to rearing space constraints. Shepherd of the Hills is the strain currently being reared at this station. They do not appear to be affected by handling or other periodic changes in their environment.

This year, low water flows (12 cfs) encountered in the month of April forced emergency planting of a large number of the rainbow on station. A tanker was called in, and 200,000 three-inch fingerlings and an additional 100,000 put-and-take catchables were immediately planted. The immediate problem was eliminated, but lower-than-normal water flows are continuing to plague this facility. Next year's rainbow put-and-take production levels have been cut by 202 in anticipation of February-March flows of around 10 cfs. During this period, Grace Hatchery is normally at maximum carrying capacity.

The fish were fed a total of 211,895 pounds of feed at a cost of $55,670. This year, the rainbow received 168,980 pounds of feed. They had an overall feed conversion of 1.09:1, and feed costs were $.23/pound. Bear Lake cutthroat were fed 42,915 pounds of semi-moist feed. They had an overall feed conversion of 1.14:1 and a feed cost of $.53/pound of fish produced. The overall hatchery feed conversion was 1.10:1, and the total cost per pound was $.734. On an average, each fish raised at the Grace Hatchery this year cost the department $.09 to feed and a total of $.90 to rear. For a species and lot breakdown, see Table 4.

SPECIAL PROJECTS

St. Charles Creek Trapping

In order to maintain a wild egg source of Bear Lake cutthroat trout, Idaho again operated a temporary cutthroat trapping operation on St. Charles Creek (an Idaho tributary of Bear Lake). According to our agreement with the State of Utah, all captured brood cutthroat are taken to Utah's Swan Creek facility to be spawned, with the exception of 20% which are put over the weir at St. Charles Creek to spawn naturally. The eggs are taken at Swan Creek and shipped to Mantua Hatchery (Utah) where they are incubated and raised to fingerling size (5.5 inches) for stocking in June.

The temporary trap was installed on April 7, 1988. It was in operation until June 22, 1988 when low water flows and a corresponding decrease in spawning cutthroat indicated the run was over. On May 28, 1988, St. Charles Creek was completely dewatered (below the state highway) for irrigation purposes, and operations were temporarily halted until flows were restored the following day. During the period of operation, a total of 297 Bear Lake cutthroat spawners were captured (121 males and 176 females; 59.32 females) (Table 5). Sixty fish were tagged and released upstream (29 males and 31 females). Two hundred and thirty-five cutthroat were transported to Swan Creek to be artificially spawned (91 males, 144 females). One female and one male cutthroat became mortalities before transportation. Two males and two females were lost at the Swan Creek

holding facility, and 12 females were released as spawn-outs. Utah personnel spawned 128 St. Charles Creek Bear Lake females, which yielded 400,900 eggs. The total eggs taken at both facilities this year was 824,145. Utah again trapped fish at Big Springs this year and transported them to Swan Creek for spawntaking. These additional eggs brought the grand total of eggs taken at Bear Lake up to 867,481 for 1988.

Little Blackfoot River Spawntaking

From April 6 to June 14, a temporary fish trap was installed and operated on the Little Blackfoot River, a tributary of Blackfoot Reservoir. The adult spawners were mostly 3- and 5-year-old Bear Lake cutthroat, with some 6-year-old fish (Figures 1 and 2). The morpholine-imprinted fish were attracted back to their original planting site with a drip station set upstream of the weir. This year, the trap site was moved downstream about 100 feet from the river's mouth at Cedar Bay. In spite of this move to improve spawntaking results, the incoming females were once again entering the trap in an overripe condition. Temperatures at the site ranged from 53 to 61°F for the duration of the spawning period (Table 6). Spawn was taken everyday starting at around 0630. One hundred and ninety-seven females were spawned, with an average number of 2,257 eggs per female (Table 7). Of the 474,595 green eggs taken this year, the overall expected yield is 110,000 fingerlings (23%) for imprinting and stocking back into the reservoir. (See Figure 3 for egg take by date.)

Other Projects

On the seventh of April, hatchery personnel traveled to the Salt Lake City Airport in Utah to pick up some air-freighted walleye sac fry shipped from Santa Rosa, New Mexico. These fry (1,006,500) were immediately planted into Oneida Reservoir. They were planted by boat, in midwater, at nightfall in three separate locations up and downstream from the Maple Grove Picnic Area. Water temperature of the reservoir was 47°F. Water conditions were slightly murky, and there was a slight choppiness to the surface. The minute fry (18,300/pound) seemed to disappear as soon as they hit the water. Mortality was estimated at less than 2%.

Grace Hatchery personnel conducted a couple of minor fish cultural experiments and/or improvements during the past year. Among these were the utilization of baffle (Venturi) boards placed upstream of the sectional dam boards in the large raceways. These 14-foot wide ponds are so wide that inadequate stream flow and low oxygenation sometimes become problems. By having these boards in place at the lower end of each 100-foot section of raceway, the bottom cleaning efficiency is increased with the increased regional flows and the dissolved oxygen level is increased by .2 to .4 ppm after passing through each Venturi set-up.

In April through May, two types of maintenance feeding diet strategies were to be compared on a side-by-side basis with both rainbow and cutthroat trout (6- to 9-inch). In the experimental ponds, rainbow were fed a production diet for 15 days (three days for 6-inch cutthroat) and then taken off feed for the next 15 days (three days for 6-inch cutthroat). In the control ponds, the maintenance diet consisted of being fed at production levels every other day. After 60 days, 30 fish from each group were to be sacrificed, necropsied, and examined. Growth rates, mesenteric fat content, and fin condition were to be analyzed, indexed, and compared. However, this experiment had to be cut short when lower-than-normal water flows were encountered during these months, bringing about premature planting and redistribution of some of these experimental fish and thus negating any type of valid results. Preliminary results indicated there was increased mortality in the experimental groups, and also a higher growth rate, when compared with the standard day-on/day-off maintenance diet currently in use.

Table 1. Fish requested and produced.

Species	Size	Production goal	Actual production	Percentage of goal achieved
Rainbow (R1)	9 in. +	300,000	291,145[a]	97
Rainbow (R8)	3-6 in.	0	228,946	excess
Cutthroat (C5)	6-7 in.	300,000	355,000	118

[a]As of September 30, 1988. By the end of October, a total of 326,621 six-inch plus rainbow were planted = 109% of goal achieved.

Table 2. Fish Health Report, October 1, 1987 to September 30, 1988 (UDNR = Utah Division of Natural Resources).

Age	Source	Species	Log I	Date	VH	VP	VE	BK	BR	BF	PW	PX	PC
brood[a]	Blkft-Egan	C5	88-69	6/2	-	-	x	-	x	x	-	x	-
1	Blkft-Egan	C5	88-70	6/2	-	-	-	-	x	-	-	x	-
0+	Egan	Rb	eggs	tested neg. by UDNR prior to shipping									
brood[a]	Blkft-Egan	C5	88-72	6/15	-	-	x	-	x	x	x	x	x

[a]Three to six-year-old returning spawners at Little Blackfoot trap.

VH = IHNV
VP = IPNV
VE = EIBS
BK = bacterial kidney disease
BR = enteric redmouth bacterium
BF = bacterial furunculosis
PW = whirling disease agent
PX = PKD agent
PC = Ceratomyxa shasta

- = negative results
x = testing/sampling not feasible

Table 3. Fish production at Grace Hatchery, October 1, 1987 to September 30, 1988.

Species & strain	Date received	Received as (or carried over*)	Source	Number	Percent hatch	Destination/ date & size	Yield	Percent survival
Rainbow (R8) Shep. of Hills	12/15/87	eyed eggs	Egan SFH, Ut.	420,223	98	Statewide 3-9/89 9"+	335,000	80% expected
Rainbow Ten Sleep	12/15/87	eyed eggs	Egan SFH, Ut.	17,864	**	- -	-	-
Rainbow (R8) Shep. of Hills	1/28/88	eyed eggs	Egan SFH, Ut.	235,509	93	Region 5 4-10/89 3-6"	200,000	85% expected
Rainbow (R1) (mixed lots)	1/7/87	*	Egan SFH, Ut.	330,280	N/A	Statewide 3-10/88 9"+	328,145. actual	99% survival from 10/1/87
Cutthroat (C5) Bear Lake	5/17/88-6/14/88	green eggs	Blackfoot Res.	474,595	31	Blackfoot Res. 6/89 6"+	110,000	23% expected
Cutthroat (C5) Bear Lake	6/1/88	eyed eggs	Egan SFH, Ut.	98,963	98	Blackfoot Res. 6/89 6"+	75,000	76% expected
Cutthroat (C5) Bear Lake	6/7/88	eyed eggs	Egan SFH, Ut.	49,776	98	Blackfoot Res. 6/89 6"+	38,000	76% expected
Cutthroat (C5) Bear Lake	6/21/88	eyed eggs	Egan SFH, Ut.	6,880	95	Blackfoot Res. 6/89 6"+	5,000	73% expected
Cutthroat (C5) Bear Lake	7/6/88	eyed eggs	Egan SFH, Ut.	8,010	95	Blackfoot Res. 6/89 6"+	6,000	75% expected
Cutthroat (C5) Bear Lake	7/12/88	fry	White Rocks SFH, Ut.	120,140	N/A	Bear Lake 5/89 6"+	105,00	87% expected
Cutthroat (C5) Bear Lake	5/87-7/87	*	Blackfoot Res. 6 Egan SFH, Ut.	361,084	N/A	Blackfoot Res. 6/88 6"+	355,000 actual	98% survival from 10/1/87

*See FY 87 report.
** Mixed in with Shep. of Hills lot-received at the same time; to maximize use of available rearing space.

Table 4. Cost of fish production at Grace Hatchery, October 1, 1987 to September 30, 1988.

Species & strain	No. / lbs. planted (or on station*)	Size	Management plan	Destination	Percent of budget**	Total cost	Cost/ fish - Pound
Rainbow (R1) (mixed strains)	291,145 / 100,207	9"+	Put and Take	Statewide	41	$58,138.00	$.20-$0.58
Rainbow (R8) Shep. of Hills	228,946 / 2,974	3-6"	Put, Grow, and Take	Region 5	3	$ 4,254.00	$.02-$1.43
Cutthroat (C5) Bear Lake	355,000 / 35,500	6"+	Species Establishment	Blackfoot Res.	31	$43,958.00	$.12-$1.24
Rainbow (RI) (mixed strains)	35,000*/ 10,607*	9"+	Put and Take (88)	Statewide	7	$ 9,926.00	$.28 -
Rainbow (R8) Shep. of Hills	341,243*/ 41,713*	6"+	Put and Take(89) Put, Grow, and Take(88)	Region 5	13	$18,434.00	$.05 - $0.44
Cutthroat (C5) Bear Lake	327,421*/ 2,180*	0-3"	Species Establishment & Re-establishment	Blackfoot Res. & Bear Lake	5	$ 7,090.00	$.02 -$3.25

* Fish still on station.
** Total costs are based on a percentage of the FY 88 operations budget.

Table 5. The 1988 St. Charles Creek Bear Lake cutthroat trapping results.

Week	No. of cutthroat	Male/ female	Length (mm)	Temp. °F	Other fish
4/7-10	0	0/0	-------	32-49	(4 days) 1 sucker
4/11-17	3	2/1	530-610	39-60	1 carp 18 suckers
4/18-24	9	5/4	510-700	42-56	5 carp 32 suckers
4/25-5/1	8	2/6	440-650	38-60	10 carp 15 suckers
5/2-8	21	16/5	530-740	32-58	2 carp 14 suckers
5/9-15	26	12/14	410-640	38-68	20 carp 23 suckers
5/16-22	39	17/22	470-760	40-64	69 carp 79 suckers
5/23-29	51	21/30	425-700	45-60	90 carp 173 suckers
5/30-6/5	61	19/42	420-690	49-66	76 carp 653 suckers
6/6-12	48	16/32	420-710	54-65	48 carp 916 suckers
6/13-19	28	9/19	435-660	57-68	27 carp 343 suckers
6/20-22	3	2/1	480-530	61-70	3 carp 21 suckers
	297	121/176	x = 588	x = 51.8	351 carp 2,288 suckers

GRACE

Figure 1. Length frequency of male C5

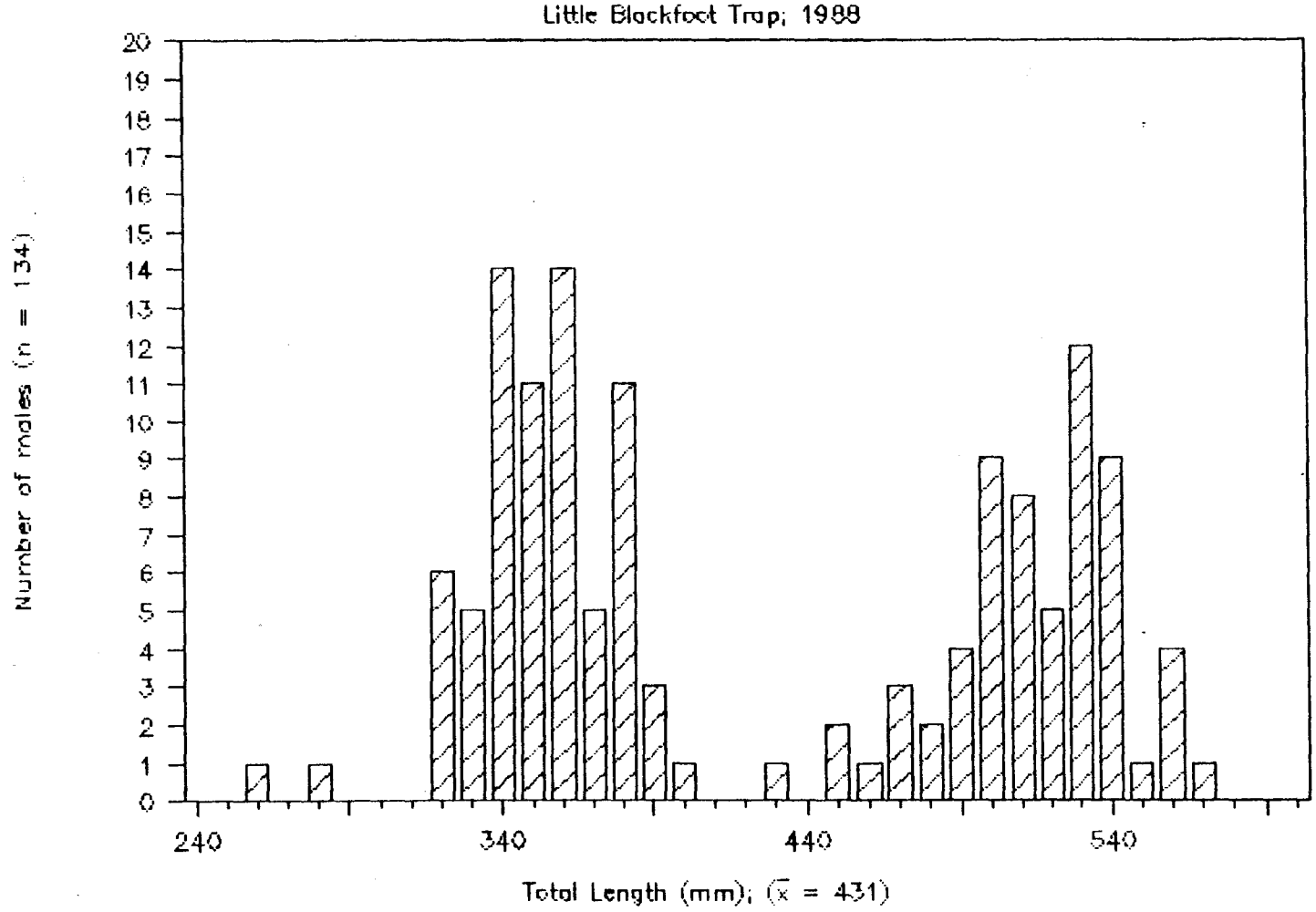

Figure 2. Length frequency of female C5

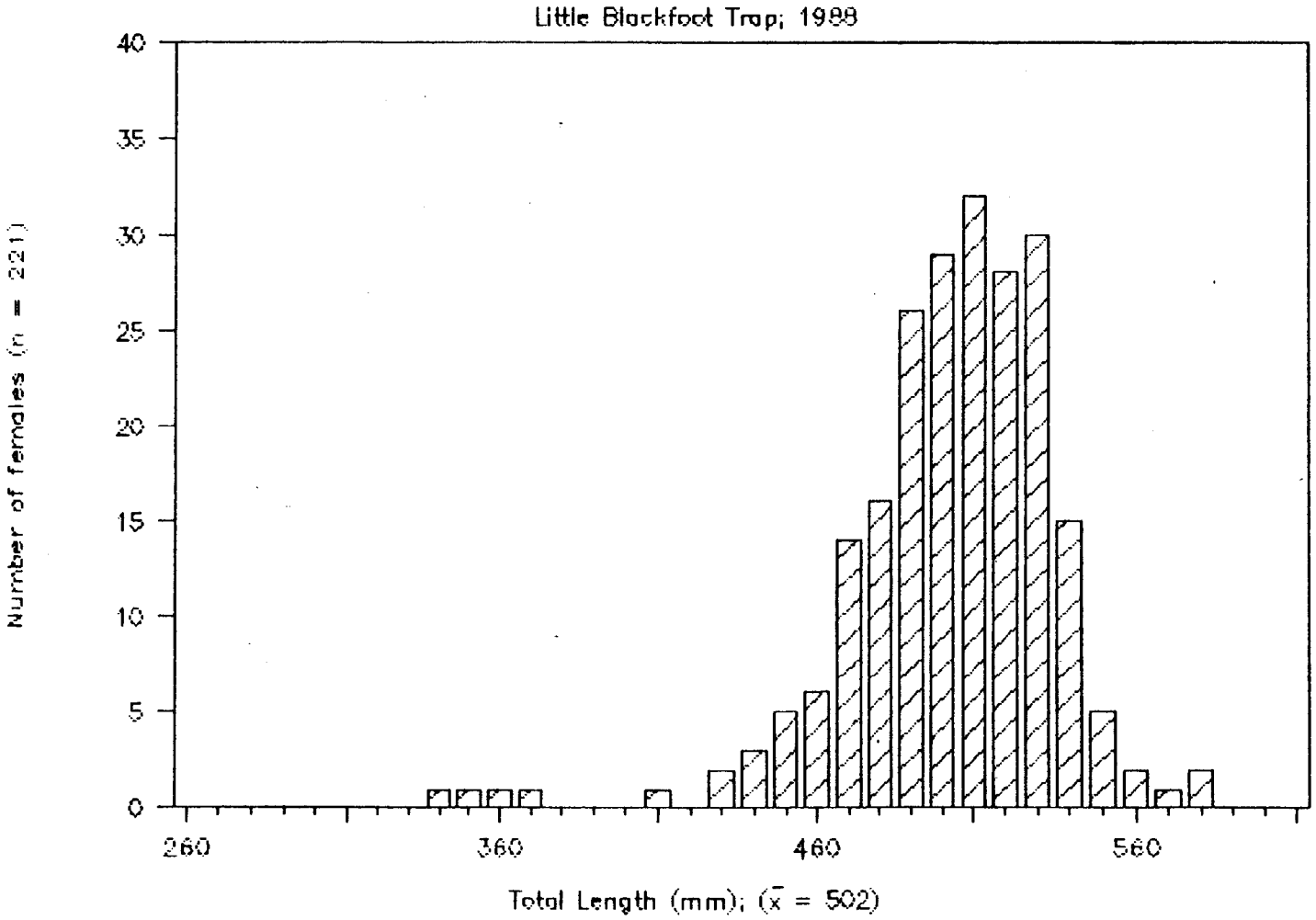

Figure 3. Bear Lake cutthroat eggtake

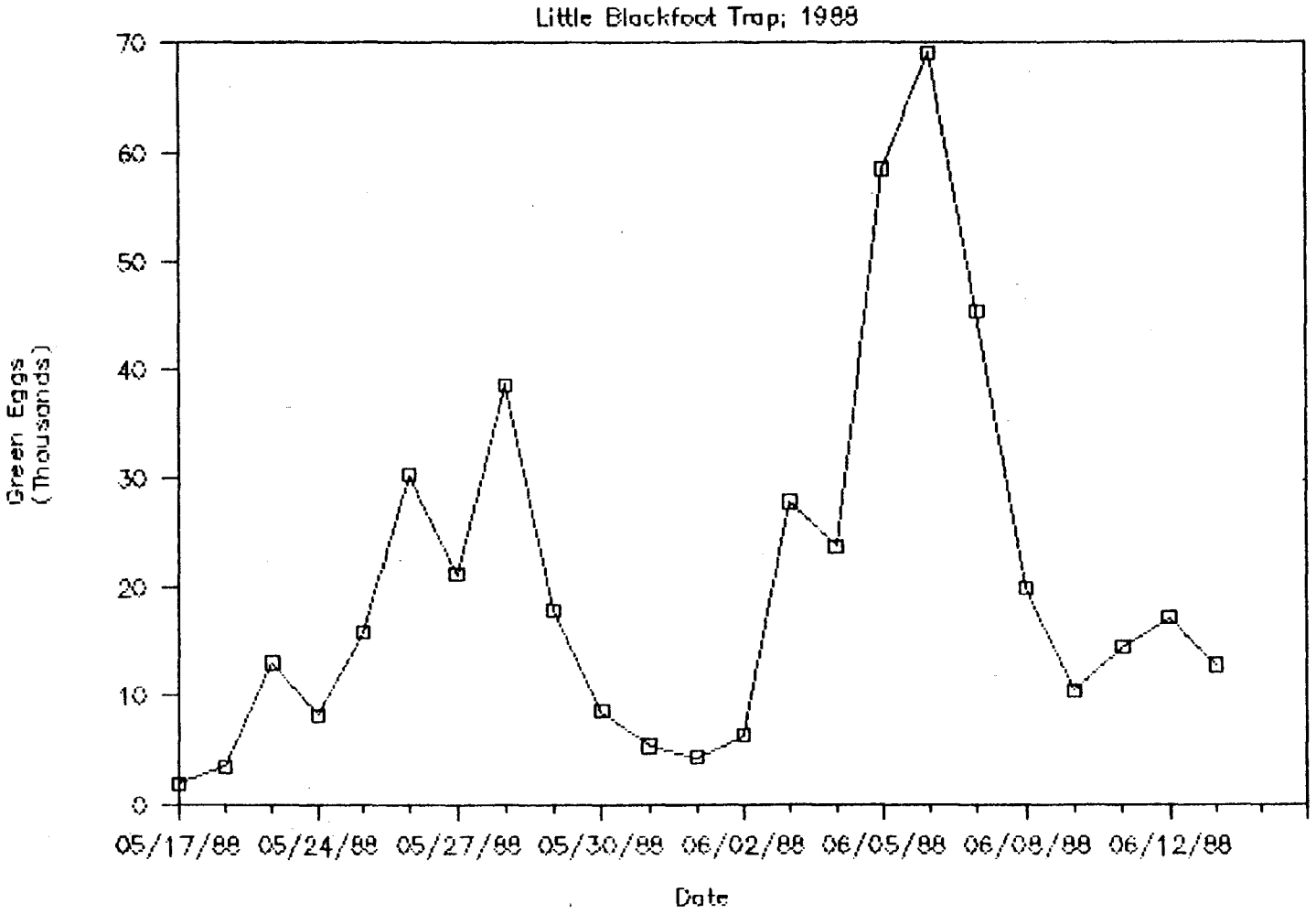

Table 6. The 1988 Little Blackfoot River Bear Lake cutthroat trapping results.

Week	No. of cutthroat	Male/ female	Length (mm)	Temp. °F	Other fish
4/6-24	0	0/0	------	46-60	77 Rb. (19 days)
4/25-5/1	1	0/1	370	41-60	42 Rb.
5/2-8	0	0/0	------	50-59	15 Rb.
5/9-15	0	0/0	------	52-61	5 Rb.
5/16-22	10	4/6	320-540	54-61	1 Rb.
5/23-29	150	78/72	260-580	55-61	1 Rb.
5/30-6/5	79	29/50	315-560	55-61	
6/6-12	102	21/81	340-560	53-61	
6/13-14[b]	38	11/27	465-550	57-61	(2 days)
	380	143/237	x - 475.5	x = 54.3[a]	141 Rb.

[a]Mean temperature during trap operation. x = 60.6 degrees Fahrenheit during actual spawntaking operation (5/16 - 6/14/88). [b]Most fish returning were already spawned out.

Table 7. Little Blackfoot River spawntaking results.

Females spawned	Eggs/ female	Green eggs	Eyed eggs	Percent eye-up	Est. cost of operation
197	2,257	474,595	171,925	36.2%	$3,400.00

HAGERMAN HATCHERY

ANNUAL REPORT

Prepared by:

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INTRODUCTION

Hagerman Hatchery is a state-owned trout production facility. The hatchery raises several strains of rainbow trout and brown trout for statewide distribution. Hagerman Hatchery is the state's largest resident trout production facility. Built in 1947, it is located approximately 30 miles west of Twin Falls on the Snake River.

The hatchery is staffed with 4 permanent employees and 16 months of temporary labor are available for use during the planting season.

The water supply includes approximately 45 to 47 cubic feet per second (cfs) from Tucker Springs and approximately 70 cfs from Riley Creek. The Tucker Springs water serves the 2,520 cubic feet of rearing space in the hatchery building, 10,530 cubic feet of rearing space in fingerling ponds, and up to 118,560 cubic feet of rearing space in large production raceways. Riley Creek water supplies the 287,280 cubic feet of rearing space available in 12 raceways. The Tucker Springs water is a constant 59°F year-round, and Riley Creek fluctuates from 54°F to 62°F on an annual basis.

HATCHERY PRODUCTION

Hagerman Hatchery produced 2,892,119 fish during fish year 1988. Of these, 1,167,951 were 8 to 10 inches long, and the remaining 1,724,168 were 3 to 6-inch fingerlings. All of the 8 to 10-inch fish were rainbow trout of various strains, while the 3 to 6-inch fish consisted of rainbow trout, brown trout, and Kamloops trout (Table 1).

A total of 5,470,366 eggs were acquired to yield the fish produced. A total of 4,203,283 eggs were purchased at a cost of $38,248.00, with the remaining 1,267,083 eggs acquired from governmental sources at no cost (Appendix A.

The fish produced from these eggs were fed a total of 658,110 pounds of feed acquired from the contract sources, Rangen, Inc. and Clear Springs Trout Co. (Appendix C). Both of these suppliers are located in Buhl, Idaho. The overall conversion was 1.39 pounds of feed to produce one pound of fish.

HATCHERY IMPROVEMENTS

Several capital improvements were completed this year. Lower Tucker Spring was captured with drain tiles and covered with rock to exclude any wild fish and other disease-carrying animals. The Bureau of Engineering painted one house, one of the garages, and the visitor center during the summer. Finally, all of the stop logs at the head of the ponds on Riley Creek water were replaced.

Capital purchases consisted of a riding lawnmower and some office equipment, including a Honeywell EP computer system and supporting software.

FISH HEALTH

The Fish Disease Lab was called to do work at Hagerman 11 times during fish year 1988. Five of the losses were due to clinical infectious hematopoietic necrosis, and six calls were for annual inspections of fish stocks. Of the six annual inspections, five yielded no disease agents, and one inspection found infectious pancreatic necrosis virus.

The fish were treated 192 times for suspected bacterial gill disease. Of these treatments, 121 were made on fish in ponds fed by Riley Creek water. Recorded losses due to suspected bacterial gill disease accounted for over a half million fish during the fish year. Clearly, steps must be taken to drastically reduce this figure.

Losses due to IHNV approached 600,000 fish of various sizes. These losses began soon after the ducks began using the Wildlife Management Unit ponds in late November and continued through the planting season. Historically, the IHN outbreaks begin during this same time period. The Mt. Lassen, Hayspur, and Wytheville strains were all affected by the IHN virus. The brown trout, Arlee rainbow, and Kamloops rainbow were not affected by the IHN virus.

These two agents were the main concerns at Hagerman Hatchery during the fish year. Other minor losses were related to Gyrodactilis sp. and bird predation.

PUBLIC RELATIONS

Hagerman Hatchery receives a large number of visitors and sportsmen throughout the year. The hatchery is surrounded by the Hagerman Wildlife Management Area. The WMA provides a large variety of outdoor experiences, ranging from fishing and hunting to family picnic uses.

Approximately 55,000 visitors toured the facility and used the surrounding public grounds this year.

SPECIAL PROJECTS

Fish Tagging Operations

The hatchery crew participated in several fin clipping and jaw tagging operations in conjunction with regional biologists' strain evaluation and recruitment work.

Island Park Reservoir was planted with 50,000 Arlee strain rainbow fingerlings that had an adipose fin clip. These fish will be monitored as part of a strain evaluation study to determine survivability of several strains and the subsequent return of hatchery fish to the creel.

Brownlee Reservoir received 30,000 8- to 10-inch Hayspur strain rainbow that had a maxillary clip as part of a similar study.

The Little Wood River system received 11,000 each of two strains of brown trout. These fish are part of a strain evaluation study. A strain from Montana received a left ventral fin clip, and a strain provided by Hayspur Hatchery received a right ventral fin clip for this study.

A fourth study involved jaw tagging 2,455 8- to 10-inch Mt. Lassen rainbow trout that were planted in Lake Walcott for a study to determine return to the creel and growth rates. Lake Walcott also received 20,000 Kamloops rainbow that had the adipose fin removed in an effort to evaluate the survivability, growth rates, and return to the creel of this strain in this reservoir.

Emerald Lake received 1,000 Mt. Lassen strain rainbow that carried jaw tags. These fish are destined to be part of another recruitment study in Region 4, as are the 1,000 Mt. Lassen rainbow that were planted in the South Fork of the Boise River that were also carrying jaw tags.

The results of these various studies can be obtained from the appropriate regional biologist as they become available.

Sturgeon Project

An exciting and challenging project has been undertaken in conjunction with the College of Southern Idaho (CSI). On July 11, 1988, the first successful spawning of a native Idaho sturgeon occurred at CSI. This appears to be the first time a sturgeon was held in captivity for over a year and successfully spawned.

In 1985, the CSI fisheries professor, Terry Patterson, initiated a proposal for, "A cooperative agreement to enhance and expand the native resource and commercial aquaculture of the white sturgeon (Acipenser transmontanus) in Idaho." The initial objective of this program is to increase the white sturgeon populations in the Snake River to a level which might become self-sustaining and increase fishing opportunity for the species. The other facet of the program is to explore further development of the commercial culture of sturgeon in Idaho.

Fishing was conducted primarily by Idaho Department of Fish and Game Region 4 fisheries research personnel, with the assistance of CSI. Set lines and rod-and-reel fishing were used to capture sturgeon. If a fish appeared to be a likely candidate for spawning, it was guided into a hooded stretcher and lifted into a boat. In order to determine sex and sexual maturity, a small (1 to 2 cm) incision was made mid-ventrally on the fish's abdomen. A clear plastic tube was inserted into the body cavity, and a sample of eggs, sperm, or gonadal tissue was removed via mouth suction. The eggs were measured to find their average diameter. Eggs were preferred to be 3.2 mm or larger. However, due to a shortage of females with eggs this large, any female with eggs larger than 2.8 mm were transported to the CSI Hatchery. The incision was sewn up and the fish released if the eggs were immature. Transportation of the fish was accomplished with the CSI flatbed truck and a linear fiberglass tank. A flow of 1 liter/hour of compressed oxygen was added to the water in the tank via carbon stones.

Two gravid females were caught and taken to CSI in the spring of 1987. These females were checked periodically throughout the summer at two to four-week intervals to see if egg diameter had increased. Some of the eggs taken during these checks were fixed in formalin and dissected along the longitudinal axis to observe the migration of the germinal vesicle toward the outer portion of the egg. The remaining eggs sampled were exposed to progesterone. The female would be receptive to hormonal inducement if the germinal vesicle dissolved after 24 hours in progesterone. However, neither female ripened completely during 1987. One female was returned to the wild after it appeared that she was reabsorbing her eggs. An 8-foot female was caught during June of 1988 and taken to the hatchery, but was later released as her eggs were already reabsorbing.

On June 9, 1988, a priming dose of carp pituitary extract was injected into the female captured on April 28, 1987. The eggs had increased in diameter from 3.1 mm to 3.5 mm from April to June. The

following day, a final dose of extract was given, and 32 hours later the fish responded. The males did not respond to the progesterone injections. The injection and spawntaking operation was performed by Terry Patterson, with assistance from Frank Chapman of the University of California, Davis.

One of the males which had been flowing earlier had developed a blockage. However, a younger male did provide approximately 50 ml of semen for fertilization. The volume of semen was probably only 20% of that needed for the 147,000 eggs obtained and is suspected of being the major cause that only an average of 10% fertilization was achieved. Additionally, the difficulty and time required to work with a fish that weighs over 100 pounds is a contributing factor to the low fertilization rate. Of the approximately 15,000 eggs which hatched, approximately 4,500 to 5,000 remain as of September 30, 1988. These fish are being reared at CSI, Rangens Research Hatchery, Clear Springs Research Lab, Canyon Springs Hatchery, and at Hagerman State Hatchery.

Hagerman Hatchery received 1,680 swim-up sturgeon fry, weighing a total of 54.2 g (14,068 fish per pound) on June 30, 1988. They were moved in styrofoam coolers lined with a plastic sack. The fish were counted and divided into two separate 1 foot x 1 foot x 4 foot troughs. Initial flow rates were 10 gallons per minute (gpm) and were increased to 40 gpm by September 30. The fish were fed by hand and with mechanical feeders continuously over a 24-hour period to make sure food was always available. They were initially fed 50% of body weight daily, which was gradually decreased to 15% body weight per day at the end of the fish year.

Two different diets were tried for rearing the fry at Hagerman. The accepted diet for sturgeon culture, Biodiet, was fed to one population, while the second population received Rangens soft-moist.

The Rangens diet outperformed Biodiet in growth rate, survival, and conversion (Figure 1). The survival rate for the Rangens diet was 35%, and the survival for those fed Biodiet was 25%. In both groups, the majority of fish died during the first three weeks on feed. This was primarily due to refusal to accept artificial feed as well as fungus problems due to excessive feed. Of the five hatcheries rearing these fish, the overall survival rate at Hagerman is second only to CSI. The difference may be due to the 55°F water temperature at CSI and the availability of CSI personnel to clean the tanks on an hourly basis when the fish were small.

The conversion rate of Rangens feed was 5.5:1, and Biodiet used 10.0 pounds of food per pound of growth. The Rangens fish averaged 8.9 g/fish, and the Biodiet fish were 6.73 g/fish at the end of the study period. This experiment was terminated at the end of the fish year, at which time both groups were fed Rangens soft-moist feed.

Body condition factor (C) was calculated on several occasions, using total length in inches and weight in pounds. The average C factor was 1.89×10^{-7}. From this, length increases were calculated to be as high as 2.66 inches per month.

On August 16, the fish were taken from the small troughs and put into a 2 foot x 2.5 foot x 8 foot vat in order to provide more volume and surface area. Sturgeon exhibit a strong desire to search out food in a relatively strong current. Roughly 90% of the fish were staying in that space upstream of the pipe. To eliminate this problem, an elbow was added to the bottom of the inlet pipe. To the elbow was attached a length of 2-inch pipe with two rows of holes' drilled at 3-inch intervals and 90° apart. This pipe ran down the trough center several inches under the water surface and reached almost to the tailscreen. On the end was a cap. All materials used were PVC. This system created two sets of current running at right angles to the pipe. This allowed the fish to spread out and utilize the vat rearing area more efficiently.

Two other benefits were derived as a result of this system. It kept the feed moving slowly on the bottom and allowed more fish to have a chance to feed. Food particles must be directly under the sturgeon's head in order for them to find it, and if the artificial diet is not picked up within a couple of minutes, it will not be consumed. This system was also nearly self-cleaning due to the two spiral currents it created. Experimentation with using this system on other fish which have an affinity for the bottom of the rearing container, such as brown trout, is planned for next year.

Firm dates and planting goals for these fish have not yet been established. However, most will probably be released in late spring of 1989. No more than 2,000 fish will be released in any one stretch of the Snake. The top priority area for receiving fish is the Wiley stretch of the Snake River below Lower Salmon Dam. The studies done by Lukens (personal communication) did not find any successful recruitment since 1974.

The fish which are released will all be tagged by at least one method. The feasibility of using PIT tags is being investigated. These tags would give each fish a number which would allow monitoring of individual fish.

Fishing for adults will occur again this fall and in the spring of 1989 in an attempt to find more adults suitable for spawning. The efficiency of capture methods, or the total fishing effort, needs to increase. One hundred eight adult sturgeon were caught in two years at a catch rate of 40 hours per fish using set lines and rod and reel. Since neither male nor female sturgeon spawn every year, it is necessary to capture several adult fish for successful annual spawn takes.

Other Activities

Other areas of participation included helping spawn chinook at Rapid River, working free fishing day, and working the pheasant opener.

Table 1. Fish requested and produced.

Species & size	Production goal	Actual production	Percentage of goal achieved
Rainbow (R1) 8-10"	1,300,000	1,167,951	89.8
Rainbow (Ri) 3-6"	1,475,000	625,250	42.4
Kamloops (K1) 3-6"	875,000	834,500	95.4
Browns (BN) 3-6"	304,000	264,418	87.0
Totals	3,954,000	2,892,119	73.1

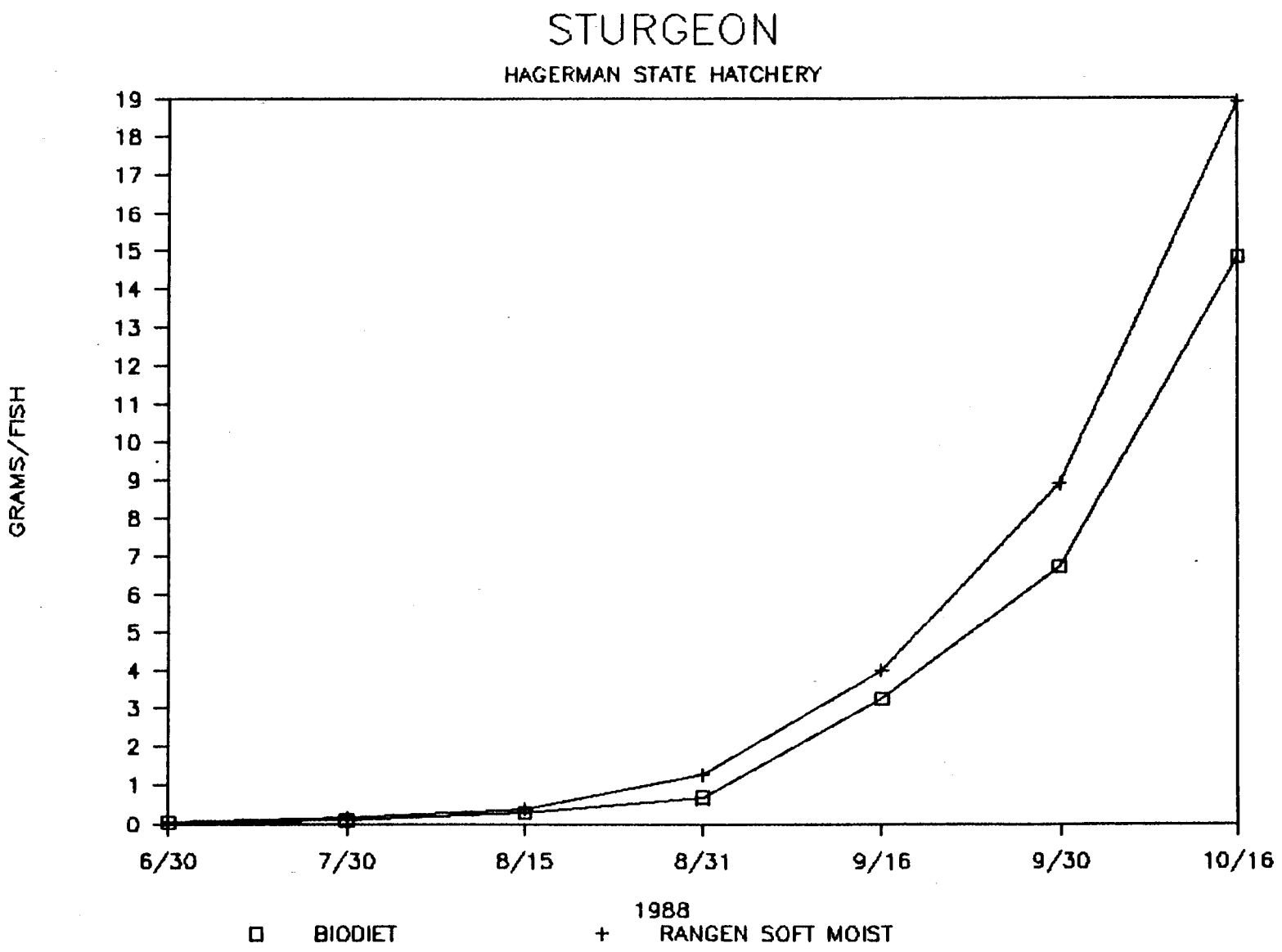

Figure 1. Growth of sturgeon fed Biodiet and Rangens soft-moist feed.

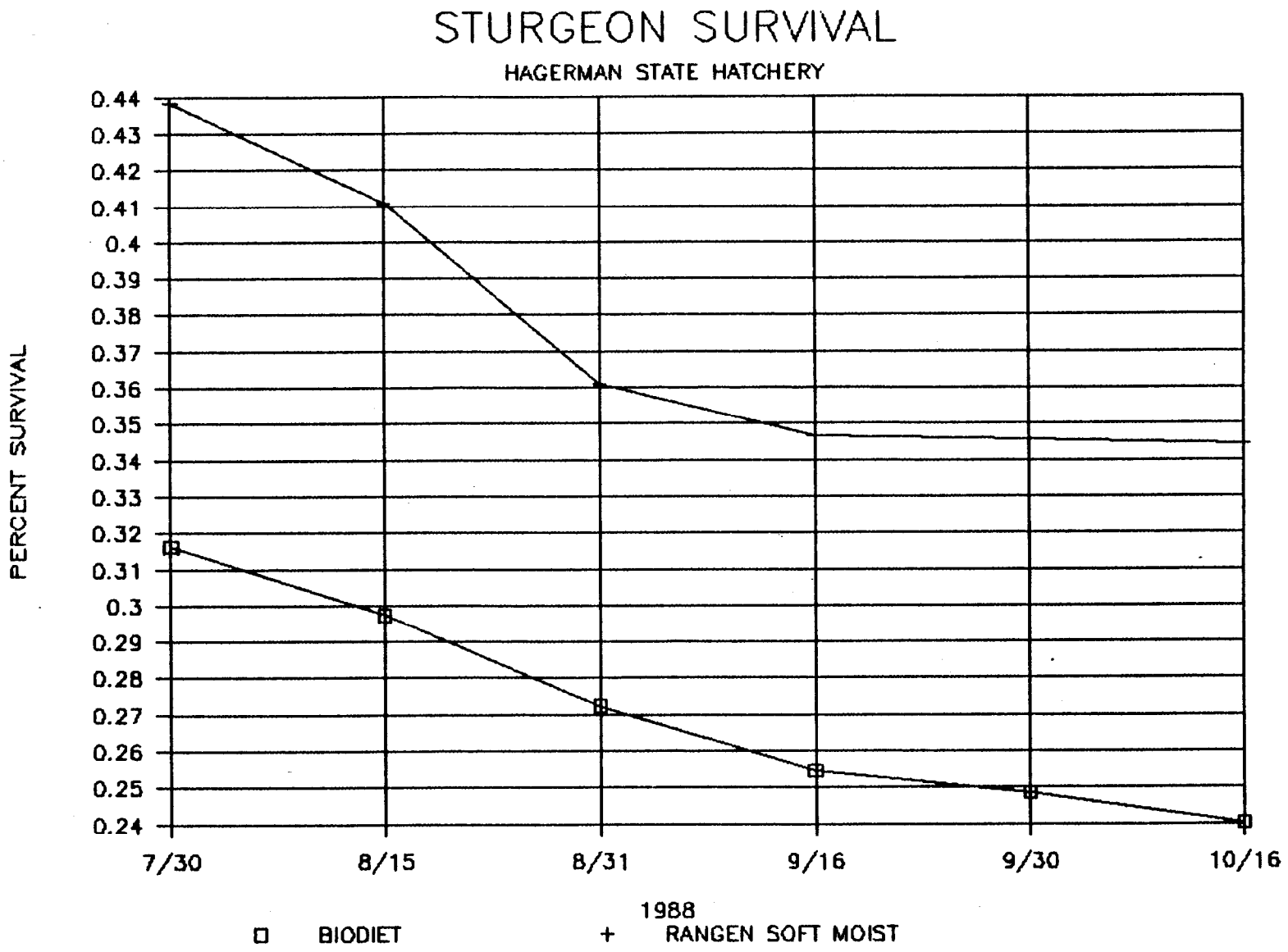

Figure 2. Survival of sturgeon fed Biodiet and Rangens soft-moist feed.

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A P P E N D I C E S

Appendix A. Numbers of eyed eggs purchased, species, cost, and source.

Species/ strain	Number received	Date received	Source	Cost
Rainbow/ Mt. Lassen	2,579,206	7 lots/ year-round	Mt. Lassen, California	$25,663.10
Rainbow/ Kamloops	1,235,880	12/16/87- 2/10/88	Skanes, Washington	$ 9,887.04
Rainbow/ Wytheville	538,712	9/25/87- 10/28/87	Tennessee/ W. Virginia	N/C
Rainbow/ Arlee	170,840	12/15/87	*Ennis, Montana*	N/C
Rainbow/ Hayspur	411,492	11/12/87	IDFG/ Hayspur	N/C
Brown trout/ Montana	388,196	11/4/87 11/23/87	Spring Creek, Montana	$ 2,697.96
Brown trout/ Hayspur	146,040	11/19/87 12/2/87	IDFG/ Hayspur	N/C
TOTALS	5,470,366			$38,248.10

Appendix B. Fish survival from eyed egg to plant, October 1987 to September, 1988.

Lot number	Eggs received	Size planted (inches)	Number planted	Percent survival
R4CA8	769,560	8-10	359,529	46.7
R4CA9	252,984	8-10	126,586	50.0
R4CA10	263,250	8-10	127,092	48.3
R4CA11	263,952	8-10	147,631	55.9
R4CAl2	280,800	8-10	144,845	51.6
R4CA13	491,260	3-6	205,950	41.9
R4CA14	257,400	3-6	218,500	84.9
RWTN1	262,070	8-10	36,800	14.0
RWWV1	276,642	8-10	84,301	30.5
RAMT1	170,840	5-10	118,486	69.3
R9ID1	411,492	5-6	139,150	33.8
MT1,2	424,492	4-6	253,124	59.6
BNID1,2,3	109,744	4-6	11,294	10.2
K1WA1	153,216	3-5	112,785	73.6
K1WA2	290,136	3-5	207,029	71.4
K1WA3	382,800	3-5	241,086	63.0
K1WA4	409,728	3-6	273,600	66.8
TOTAL	5,470,366		2,807,788	51.33

Appendix C. Fish feed used during fish year 1988 at Hagerman Hatchery.

Size	Source	Pounds	Cost/ pound	Cost
Starter	Rangens	800	$0.2900	$ 232.00
11 Crumble	Rangens	3,000	$0.2900	$ 870.00
	Clear Springs	1,200	$0.3105	$ 372.60
12 Crumble	Rangens	9,000	$0.3105	$ 2,794.50
	Clear Springs	4,150	$0.3105	$ 1,288.58
13 Crumble	Rangens	6,000	$0.2900	$ 1,740.00
	Clear Springs	14,500	$0.3105	$ 4,502.25
14 Crumble	Rangens	4,500	$0.1950	$ 877.50
	Clear Springs	17,850	$0.2557	$ 4,564.25
15 Crumble	Clear Springs	7,500	$0.2557	$ 1,917.75
3/32" Pellet	Rangens	29,350	$0.1650	$ 4,842.75
	Clear Springs	35,860	$0.2302	$ 8,254.97
1/8" Pellet	Rangens	250,700	$0.1650	$ 41,365.50
	Clear Springs	273,450	$0.2093	$ 57,233.01
Soft-Moist Starter	Rangens	100	$0.6600	$ 66.00
Soft-Moist 1/32	Rangens	150	$0.5940	$ 89.10
Totals		658,110		$131,010.76

Appendix D. Costs of fish produced at Hagerman State Hatchery, FY 1988. Costs reflect all costs budgeted except capital outlay and personnel.

Species, strain & size	Actual production	Costs to produce & plant
Rainbow (R1) 8-10 in.	1,167,951	$ 71,883
Rainbow (R1) 3-6 in.	625,250	$ 38,482
Kamloop (K1) 3-6	834,500	$ 51,361
Brown (BN) 3-6 in.	264,418	$ 16,274
Totals	2,892,119	$178,000

HAYSPUR HATCHERY

ANNUAL REPORT

Prepared by:

John Thorpe, Fish Hatchery Superintendent II
John Siple, Fish Hatchery Superintendent I
Kevin Price, Fish **Culturist**

INTRODUCTION

The Hayspur Hatchery is a rainbow trout production and broodstock facility located on Loving Creek, approximately 18 miles southeast of Hailey, Idaho. Available water includes: (1) Loving Creek, 8 to 22 cfs, which ranges from 32 to 70ºF; (2) a hatchery spring, 5 cfs, at 53ºF; (3) two artesian wells, 2.5 cfs, at 53°F; and (4) spring seeps to broodstock pond, 2.0 cfs, also at 53°F. All water has varying degrees of nitrogen gas supersaturation, up to 130%, and dissolved oxygen from 3 ppm to 11 ppm. Rearing units include Heath incubator stacks, concrete early rearing vats, raceways, and an earthen pond. Broodstock are held in an earthen pond and trapped in one of the small concrete raceways.

HATCHERY IMPROVEMENTS

One pair of small raceways was enclosed with plastic netting to provide isolated rearing for broodstock replacement fish. The project was accomplished with hatchery personnel and provided excellent protection from piscivorous birds, mammals, and visitors, which prevented incidental disease transfer.

Electric fencing was installed on the large raceways to reduce depredation. The fencing was made easily removable so that it would not interfere with snow-removal work.

New desks, chairs, and bookcases were procured to improve function and appearance of the office.

FISH PRODUCTION

Catchable size (Size 3) and fingerling (Size 2) production (Table 1), although normally from eggs collected on station, was augmented with 550,000 Mt. Shasta strain (R5) eggs received in February 1988 from the Ennis NFH. This allowed production of 200,000 more fingerlings than in

1987 by staggering the loading of fingerling raceways. The fingerling production goal for 1988 was 62% greater than 1987, and although production was up, it still fell short of the demand. The survival from eyed egg to fingerling was considerably better in R9 fish, 73% versus 58% in R5 fish (Table 2). An increase in production during 1988 was noteworthy in that 20Z of the early, rearing and 33% of the fingerling rearing units were designated for isolation of broodstock replacement eggs and fish.

Production of 9- to 10-inch trout met all stocking and transfer demands for 1988 but fell below the goal by 14% (Table 1). Total poundage was lower (Table 3) than in past years, with an average size of fish stocked or transferred of 3.6/pound. Poor water quality affected growth as well as survival during April and May, when, during normal years, warmer water temperatures would usually boost growth. Large mortalities were experienced in subcatchable fish raised in Loving Creek water. A reduction in dissolved oxygen to below 5 ppm after dark in Loving Creek water, coinciding with the cessation of photosynthesis in aquatic vegetation, was determined to be the cause of a 2,700 fish loss. To mitigate this oxygen deficiency, recirculation pumps were activated, and care was taken to feed only early in the day. The reduced feed regimen inhibited growth, while the pumping introduced sufficient organic material into the headrace to block water flow into two raceways, resulting in the loss of over 20,000 fish. Water level alarms have been acquired, and dredging has been completed to improve water quality.

FISH HEALTH

Fish health was excellent during the past year, with only a few mild cases of bacterial gill disease which were treated successfully with copper sulfate ($CuSO_4$).

In support of an IPNV eradication program to provide disease-free broodstock for the Hayspur Hatchery, 190 fluid (ovarian, seminal, and fecal fluid) and 54 tissue (kidney, spleen, and gill) samples were examined and determined negative for viral agents. Adult fish were examined for Myxosporidiosis, and although Myxobolus sp. spores were detected, M. cerebralis was not diagnosed. These samples were collected over a three-month period to be representative of the entire population.

Ovarian and seminal fluid samples from five brown trout captured in the Big Wood River were sampled and determined to be negative for viral pathogens.

During July 1988, random samples of production fish were taken. Sampled fish were negative for BKD, viral pathogens, and Ceratomyxa shasta.

PUBLIC RELATIONS

Visitor use was estimated at over 8,000 persons, with both walk-in visitors as well as campers. The campground was used less than in past years, with only 5 to 10 parties in residence per week. Major use was from April to September. We completed the visitor information board with area maps, regulations, and a covered box for brochures. A policy for a campground host program was developed and published to be implemented in 1989.

Presentations were made at local schools and clubs in addition to tours given locally.

SPECIAL PROJECTS

IPN Eradication Program

In preparation for expansion of broodstock operations at the Hayspur Hatchery, a program to secure disease-free adult fish from a population identified positive for IPN was initiated. To maximize genetic variability while constrained by physical limitation of the hatchery, it was determined that 15 pairs of parents would be spawned from three separate dates spread over the spawning season. This would provide progeny from 90 parents. The eggs from each individual pair would be incubated and reared in isolation until the parents had been determined to be free of viral pathogens. These disease-free fish would then be reared in a disease-free environment until new broodstock holding ponds were available.

Isolation incubators were constructed from 5-gallon buckets and mounted in early rearing vats, providing not only an individual water supply and drain but preventing cross-splash or vapor-born transmission of IPNV. Water flow to these incubators was inconsistent and resulted in the loss of several lots from both gas bubble and high-flow blowouts as well as flow stoppage.

Fifteen pairs of adults were selected and spawned, and the eggs from each pair kept in isolation. The adults were branded using silver nitrate swabs and held in an isolated raceway subsequent to spawning. Ovarian and seminal fluids were taken at spawning one week later, and then tissue samples were taken two weeks postspawning. Some lots were lost due to poor brand retention, making it impossible to identify parents. Additionally, some adults escaped to the rearing pond where they were held. This spawning and sampling procedure was carried out three times. The surviving offspring were then split, with one-half transferred to the American Falls Hatchery while the other half was retained at Hayspur.

Of 50 pairs of adults spawned, 32 lots survived to provide for the 1987 brood year replacement fish. All parents were found to be negative for viral pathogens. Losses were due to infertility as well as mechanical failure of the incubators.

Brown Trout

A brown trout trapping operation was carried out on the Big Wood River in October and November 1987. A picket weir with a cedar slat trap fyke was put in place October 1. The trap captured only three fish until the 23 of October. During that week, the trap was modified in an attempt to attract brown trout. Adult brown trout had been observed holding in pools below the trap. Additional shade was created on the trap with no increase in efficiency, although some browns were captured by dip net. On October 28, a floating canopy of plywood was put in place to provide uninterrupted cover from a large holding pool into the trap. During the next day, 47% of all browns trapped were collected. The provision for total cover was successful in this case. During the 1987 season, 99 brown trout were trapped: 68 females and 31 males. Eggs were taken from 42 females, with 111,178 eyed eggs shipped to the Hagerman SFH.

Golden Trout

Golden trout trapping was carried out at Baker Lake this year. Trout that were stocked in 1987 were expected to be within the 200 to 300 mm range in 1988, and might be captured at the outlet. A large live box and trap materials were ferried into the lake by snow machine during March. Several trips were made into the lake prior to installing the trap fyke on May 25. Both golden trout and Henrys Lake cutthroat were trapped from May 25 to June 22 (Table 5). None of the golden trout females were ripe this year. The cutthroat captured were all ripe. To prevent crossbreeding, the trapped cutthroat were carried by dip net past a barrier on Baker Creek and released downstream.

Table 1. Fish requested and produced, October 1, 1987 to September 30, 1988.

Species & size	Production goal	Actual production	Percentage of goal achieved
Rainbow 3 in. plus	1,175,000	906,779	77.2
Rainbow 9 in. plus	270,650	232,406	85.9

Table 2. Fingerling production, October 1, 1987 to September 20, 1988.

Species	Source eggs	Eyed Eggs	Survival to fingerling	Stocked as fingerling	Destination	Cost	Comments
Rainbow (R9)	Hayspur SFH	1,223,166	888,562 (73%)	583,592	Reservoirs in Regions 3, 4 & 6	$40,000	Nonstocked R9 fish held for Catchable rearing.
Rainbow (R5)	Ennis NFH	549,508	362,246 (58%)	318,566	- - - - - - Same - - - - - - - - -	Included above	Remainder transferred to Hagerman SFH.

Table 3. Catchable size trout production, October 1, 1987 to September 30, 1988.

Species	Source	Number of Size 2 fish held on October 1, 1987	Pounds at beginning	Number of Size 3 fish stocked-transferred	Pounds stocked-transferred	Percent survival	Cost
Rainbow (R9)	Hayspur SFH	299,896	19,208	232,406	64,562	78	$90,000

Table 4. Hayspur strain rainbow trout spawning at Hayspur Hatchery, October 1, 1987 to September 30, 1988.

Number of females spawned	Green eggs	Eyed eggs	Percentage eye up	Survival to feeding fry	Percentage survival to feeding fry	Survival to fingerling	Percentage survival to fingerling
725	2,037,036[a]	1,643,244[a]	81	980,531	64	888,562	58

[a]tncludes eggs transferred to other hatcheries.

Table 5. Number and mean lengths (mm) of trout trapped at Baker Lake, May 31, 1988 to June 22, 1988.

Species	Number trapped	Mean length	Range
C3 male	48	271	132-345
C3 female	43	291	225-355
C3 trout	91	281	132-355
GN male	41	210	120-254
GN female	32	193	150-226
GN trout	73	202	120-254
Diseased Fish[a] (included in totals)			
C3 male	2	140	132-149
C3 female	1	275	275
C3 trout	3	185	132-275
GN female	7	184	120-219
GN female	21	188	150-234
GN trout	28	187	120-234

[a]Diseased trout exhibited signs of peduncle disease.

HENRYS LAKE HATCHERY

ANNUAL REPORT

Prepared by:

Brad George, Fish Hatchery Superintendent I

INTRODUCTION

Henrys Lake Hatchery is located in the Island Park area of Fremont County in east-central Idaho. The spawning building was constructed in the 1920s to collect Henrys Lake cutthroat eggs. The hatchery is still used primarily as an egg taking station and ships eyed eggs of cutthroat (Salmo clarki), rainbow x cutthroat hybrids (S. clarki x S. gairdneri), and brook trout (Salvelinus fontinalis) to Ashton and Mackay hatcheries.

HATCHERY IMPROVEMENTS

Major hatchery improvements include the following:

1 Complete repainting of the interior of the residence, along with repairing torn carpets, fixing plumbing and the electrical system, and rebuilding of the storage areas.

2. Installation of a pole fence around the residence.

3 Complete cleaning of the crew's cabin.

4. Insulating the attic area of the hatchery building above the office, storage room, and garage.

5. Patching the concrete floor in the garage and then painting the concrete floor, walls, and window frames.

6. General clean-up and landscaping of grounds to improve the overall, appearance of the facility. Significant improvements included removal of a loading dock, several old fences, and various old hatchery items as well as weed and brush removal and reseeding of some lawn areas.

FISH HEALTH

Brood year pathogen surveys of naturalized brook trout and Henrys Lake cutthroat were completed during the 1987-1988 spawning season by personnel from the Eagle Fish Health Lab.

On October 27, 1987, naturalized brook trout were inspected for viral pathogens and bacterial kidney disease. All brood fish sampled were negative for disease agents.

Henrys Lake cutthroat brood fish were inspected on May 25, 1988 for viral pathogens, bacterial kidney disease, enteric redmouth bacterium, and bacterial furunculosis. Two of 20 brood fish tested positive for bacterial furunculosis. Results were negative for all other viral and bacterial pathogens.

SPAWNTAKING OPERATIONS

Operation of the fall fish traps for brook trout ran from the middle of October to the middle of November, 1987. Traps were placed at Duck Creek, Timber Creek, and at Hatchery Creek. Naturalized brook trout were trapped at all three sites. Temiscamie brook trout were trapped at Hatchery Creek only. A total of 305,000 brook trout eggs were collected (Table 1).

The hatchery fish trap for cutthroat was installed on February 29, 1988 and continued through June 4, 1988. During this time, approximately 20,000 cutthroat and 3,000 hybrids ascended the fish ladder. A total of 1,570 female cutthroat was spawned to produce 2,132,800 green cutthroat eggs. An additional 657,700 cutthroat eggs were fertilized with milt from Kamloops and McConaughy strain rainbow to produce hybrids. Milt was acquired from Ennis National Fish Hatchery in Montana and transported fresh to Henrys Lake. Average fecundity for all females spawned was 1,777 eggs per female. A total of 56,000 Kamloops hybrids was treated with 17-alpha-methyltestosterone (MT) to produce sterility. All F1 generation hybrids returning to the hatchery were stripped of eggs and milt and the spawn destroyed to prevent dilution of the gene pool. A summary of spawning activities is presented in Table 1.

Eggs were eyed-up, shocked, and picked before being shipped to other hatcheries. Essentially, all egg requests were met or exceeded at Henrys Lake Hatchery in 1987-1988. A summary of eyed eggs shipped and requested at Henrys Lake Hatchery is presented in Table 2.

PUBLIC RELATIONS

During the past year, an estimated 2,000 visitors came to the hatchery for tours, information, and to fish. In addition, 19 landowners owning land adjacent to tributaries of Henrys Lake were contacted in an effort to improve relations and gain support for department-sponsored habitat improvement projects. Several hundred hours were spent interviewing fishermen on the lake and working with the Henrys Lake Foundation and Island Park Sportsmen's Group, completing projects such as fish salvage operations on Henrys Lake Outlet, digging out the mouth of tributaries for fish access, and planning habitat improvement projects.

Contacts with local newspapers during the past year included several articles on spawning activities, an introductory article on the new Hatchery Superintendent, black bear problems at Henrys Lake, and fish salvage efforts in the Henrys Lake Outlet.

Public relation plans for next year include converting the old rearing pond into a show pond for visitors, installation of a fish food vending machine for the show pond, and writing a visitor information pamphlet about the hatchery and lake.

Table 1. Spawning summary at Henrys Lake Hatchery, 1987-1988.

Species	Green eggs	Eyed eggs	Percent
Brook (Natural)	127,000	99,900	78
Brook (Temiscamie)	178,000	120,400	68
Cutthroat (C3)	2,132,800	1,754,30	82
Cutthroat x Kamloops (C3 x K1) normal	340,000	204,000	60
Cutthroat x Kamloops (C3 x Ki) hormone	93,000	56,000	60
Cutthroat x McConaughy (C3 x R6) normal	224,400	147,000	65
Totals	3,095,200	2,381,600	77

Table 2. Eyed eggs shipped from Henrys Lake Hatchery, 1987-1988.

Species/strain	Eyed eggs shipped	Eyed eggs received	Percent ' goal achieved	Destination	Cost	Comments
Cutthroat (C3)	1,754,000	1,525,000	115	Mackay	$7,000	
Subtotal	1,754,000					
C3 x K1 (normal)	204,000			Mackay	$ 500	Ennis NFH
C3 x K1 (hormone)	56,000			Mackay	$ 175	Ennis NFH
C3 x R6 (normal)	147,000			Mackay	$ 325	Ennis NFH
Subtotal	407,000	385,000	105		$1,000	
Brook (Natural)	64,000	-		Ashton	$ 350	Excess
Brook (Temiscamie)	120,000	120,000	100	Ashton	$ 550	
Brook (Natural)	35,000	35,000	100	Clark Fork	$ 200	
Subtotal	219,000	155,000	141		$1,100	
GRAND TOTAL	2,380,000	2,085,000	114		$9,100	

MACKAY FISH HATCHERY

ANNUAL REPORT

Prepared by:

Bill Doerr, Fish Hatchery Superintendent II
Ivan Talbott, Fish Hatchery Superintendent I
Julia Hensel, Fish Culturist

INTRODUCTION

The Mackay Hatchery operates under "specialty" status, producing fish of various species and strains from 1 to 12 inches in length for statewide distribution. Production for the year exceeded 3.68 million fish, with a net poundage of 138,000 pounds (Table 1).

The hatchery achieved at least 100% of each production goal for the year (Table 2).

Cost of fish produced averaged $1.056 per pound and $.0396 per fish (Table **3).**

Included were five species for a total of 16 different strains as follows:

Rainbow Trout
- Tensleep (Wy)
- Shepherd of the Hills (Mo)
- Pennask River (BC)
- Mt. Lassen (Ca)
- Mt. Shasta (Ca)
- Lake McConaughy (He)
- Eagle Lake (Ca) Duncan
- River Kamloops
- Lardeau River Gerrard (Kamloops)

Cutthroat Trout
- Henrys Lake
- West slope
- Rainbow x Cutthroat Hybrids
- Henrys Lake Cutthroat x Duncan River Kamloops
- Henrys Lake Cutthroat x Lake McConaughy Rainbow

Coho Salmon

Fall Chinook Salmon

Grayling

HATCHERY IMPROVEMENTS

1. Ten new raceways, each 4 foot x 4 foot x 40 foot, were added to increase swim-up and nursery space.

2. Two new fiberglass troughs, each 15 foot x 2 foot x 2 foot deep, were added to the battery of incubation troughs.

3. The bay doors on the garage at Residence No. 2 were removed, resized, and replaced to allow access to modern-sized automobiles.

4. The exteriors of residences No. 1 and No. 3 were repainted by the hatchery crew.

5. Pumps for fighting fires and tempering were installed on both two-ton fish trucks.

6. Five directional signs and a hatchery entrance sign were installed to direct visitors to the hatchery.

7. A weir was constructed and installed at the downstream end of the large raceway tailrace to keep wild fish from Warm Springs Creek away from the raceways.

FISH HEALTH

No infectious fish diseases were experienced in Mackay production fish this year. A presumptive diagnosis of whirling disease (Myxobolus cerebralis) was made on wild fish from Warm Springs Creek below the hatchery. No histological confirmation of that diagnosis has been made as of the date of this report.

A summary of disease inspections is included in Table 4.

FEED STUDY

A 30-day feed trial was undertaken to compare feed conversion of Rangens brand trout and salmon feed to Clear Springs brand trout feed. The Rangens feed was their standard feed, 5/32 pellet. The Clear Springs feed was made to Idaho contract specifications, 5/32 pellet. Two adjacent raceways were selected with identical loadings and identical flows. Fish in the raceways were from the same lot and were the same size and age. Both groups were a mixture of Tensleep (Montana) and Shepherd of the Hills (Missouri) strains of rainbow trout. Both groups were fed on the same hatchery constant twice daily. Fish were crowded and sample counted eight

times in each group at the beginning and end of the study. The Rangens feed converted at 1.2 pounds of feed per pound of fish gained. The Clear Springs feed converted at 2.5 pounds of feed per pound of gain. Feed cost per pound of fish gained was $0.2478 for the Rangens group and $0.5592 for the Clear Springs group (Table 5).

PUBLIC RELATIONS

Approximately 700 people toured the hatchery during the year. Due to its remote location and unfavorable climate, few people actually seek out the hatchery. Most are hunters and fishermen who happen here incidental to other activities.

Several groups of school students from the Mackay and Butte County districts were taken on tours of the hatchery.

A video explaining hatchery operations was begun. It was, however, never finished as the hatchery has no equipment for production, and the equipment that was borrowed had to be returned.

Two new releases were prepared for the local newspaper concerning stocking operations from the hatchery.

RAINBOW TROUT STRAIN EVALUATION

Several strains of rainbow trout have been raised at the Mackay Hatchery for the ongoing strain evaluation. Though the evaluation has been abandoned by the regions, some comments on hatchery performance of those strains used this fish year are included here. The Mt. Lassen and Pennask River rainbow are not mentioned as they were not here long enough to compare. The Tensleep and Shepherd of the Hills rainbow were mixed as eggs, so they cannot be evaluated differentially.

Mt. Shasta (RS) rainbow are the most domesticated strain that were raised. They were started on soft-moist feed but were switched to dry feed at 2,000/pound. Conversion was good at 1.2. They were held at density indices of up to 0.4 but began to show fin erosion at that level. They fed readily and showed fairly uniform growth at 0.023 inches per day.

Lake McConaughy (R6) rainbow are a much wilder strain. They were started on soft-moist feed and converted to dry at 900/pound. Conversion was fair at 1.32. Density index was kept below 0.3 as they exhibited a reluctance to feed at greater densities. They fed low in the water column, only under shade, and only after the person feeding had moved down the raceway. They would only eat 0.4% of their body weight at a feeding so they had to be fed numerous times a day. There was little uniformity in sizes, although average growth was good at 0.021 inches per day.

Eagle Lake (R7) rainbow are also a wilder strain. They were started on semi-moist feed and converted to dry at 1,500/pound. Conversion was excellent at 1.13. Density index was kept below 0.3 as they exhibited a reluctance to feed at greater densities. They fed high in the water column, but only under shade, and only after the person feeding had moved down the raceway. They also would only eat 0.4% of their body weight at a feeding so they had to be fed numerous times a day. There was little uniformity in sizes, although average growth was good at 0.020 inches per day. The Eagle Lake rainbow were continually moving upstream in the raceway and could be crowded efficiently only in an upstream direction.

Duncan River Kamloops (K2) behaved more like a domesticated strain, although growth and conversion were not as good as would be expected by their behavior. They were started on semi-moist feed and converted to dry diet at 2,000/pound. Conversion was fair at 1.35. Density index could be kept at 0.45 with no apparent stress on the fish or excessive fin erosion. They spread throughout the raceway and accepted feed readily. There was good uniformity in sizes but only fair growth at 0.018 inches per day.

Lardeau River Kamloops (K2) exhibited very wild behavior. They were kept on semi-moist feed until they reached 30/pound. Conversion was excellent at 1.1, but they had to be fed by Allen feeders as they became extremely agitated in the presence of people. They were kept inside the hatchery building and were 100% covered with screens as they jumped continually. Density index was kept below 0.25 to maintain fin quality. Grgater densities were not attempted. Sizes were extremely erratic, with fish ranging from 3 inches to 10 inches at stocking. Average growth was poor at 0.0167 inches per day.

Table 1. Fish production at Mackay Hatchery, October 1, 1987 to September 30, 1988.

Species & strain	Lot number	Source	Received as	Number/pounds received or carried over(*)	Yield (number/pound)	Destination	Comments
Rainbow R1 Tensleep & Shepherd of the Hills	7-U-Ut	Egan SFH, Utah	eyed eggs	193,764/ 17,614*	192,807 68,516	Region 6 catchables	
Mt. Shasta	6-En-R5	Ennis NFH, Montana	eyed eggs	24,000/ 12,691*	24,115 18,550	Region 6 catchables	
Kamloops K2 Lardeau River	7-F-Can	Kootenai Hatchery Wardner, B.C.	fry	5,000/ 34*	4,875 420	Cabinet Gorge Hatchery	For imprinting prior to release
Cutthroat C2 Westslope	7-U-Id-16	McCall SFH, Idaho	fry	29,610/ 159*	29,350 2,100	Payette Lake	
Fall Chinook Wolf Lodge	7-U-Id-46	Cabinet Gorge Hatchery, Idaho	eyed eggs	75,649	59,750 2,600	Coeur d'Alene L. Mormon, Chesterfield	LV fin clip
Coho Columbia River	8-WS	Little White Salmon NFH, Washington	eyed eggs	800,000	670,000 22,333	Cascade Reservoir	
Coho Columbia River	8-Wd	Willard NFH, Washington	eyed eggs	911,777	793,160 23,127	Island Park & Ririe reservoirs	
Rainbow R5 Mt. Shasta	8-En-R5	Ennis NFH, Montana	eyed eggs	159,340	106,050 9,446	Region 6	1989 catchables
Rainbow R6 McConaughy	8-En-R6	Ennis NFH. Montana	eyed eggs	128,856	85,675 2,502	Lost Valley Res., Mackay Res.	LV fin clip for Lost Valley
Rainbow R7 Eagle Lake	8-Ct-R7	Creston NFH, Montana	eyed eggs	107,730	90,375 2,839	Lost Valley & Mackay reservoirs	

Table 1. Continued.

Species & strain	Lot number	Source	Received as	Number/pounds received or carried over(*)	Yield (number/ pound)	Destination	Comments
Kamloops K2	8-En-K2	Ennis NFH, Montana	eyed eggs	95,580	52,925	Mackay Reservoir	
Duncan River					2,015		
Rainbow R4	8-Y-Ca	Mt. Lassen Trout	eyed eggs	50,000	45,425	Region 6 Mtn. lakes	
Mt. Lassen		Farm, California			46.79		
Rainbow RP	8-F-Can	Sumnerland Trout	fry	14,898	14,888	L. Payette Lake	
Pennask River		Hatchery, B.C.		16	30		
Cutthroat C2	8-U-Id-16	McCall SFH, Idaho	fry	94,250	94,450	Region 6 Mtn. lakes ('88)	
Westslope				130	221.1	Payette Lake ('89)	
Grayling	8-U-Id-07	Ashton SFH, Idaho	fry	26,000	26,000	Region 6 Mtn. lakes &	
				5.3	16.65	Wildhorse Creek.	
Cutthroat C3	8-U-Id-C3	Henrys L. SFH,	eyed eggs	1,531,780	1,056,000	Henrys Lake	
Henrys Lake		Idaho			10,245		
RB x CT hybrids	8-RCA	Henrys L. SFH,	eyed eggs	204,000	169,050	Henrys Lake	Normal hybrids
RC (K2 x C3)		Idaho			2,450		
RB x CT hybrids	8-RCB	Henrys L. SFH,	eyed eggs	159,320	123,000	Henrys Lake	
RC (R6 x C3)		Idaho			850		
RB x CT hybrids	8-RCHOR	Henrys L. SFH,	eyed eggs	56,000	44,850	Henrys Lake	Sterilized with
RC (K2 x C3)		Idaho			650		methyltestostero

Table 2. Fish requested and produced at Mackay Hatchery, October 1, 1987-September 30, 1988.

Species and size	Production goal	Actual production	Percentage of goal	Comments
4 in. coho salmon	1,108,000	1,463,160	132	Requests were increased due to egg availability.
4-5 in. fall chinook	50,000	59,750	119	
3 in. Henrys Lake cutthroat	1,042,000	1,056,000	101	
3 in. rainbow x cutthroat hybrids	325,000	336,900	104	
1 in. grayling	5,000	26,000	520	Requests were increased due to fry availability.
4 in. unspecified rainbow	132,000	168,975	128	
4 in. Lake McConaughy rainbow	30,000	30,000	100	
4 in. Eagle Lake rainbow	30,000	30,000	100	
6 in. westslope cutthroat	25,000	29,350	117	
1 in. westslope cutthroat	67,000	94,450	141	
1 in. golden trout	4,000	0	0	No eggs received.
1 in. unspecified rainbow	8,000	45,425	567	Requests increased during fish year.

Table 3. Survival and cost of fish reared at Mackay Hatchery, October 1, 1987-September 30, 1988.

Size, species, and strain	Percent survival from beginning of fish year to stocking	Percent survival from egg to stocking	Cost[a]	Cost/ fish	Comments
10 in. Tensleep 6 Shep-hills rainbow	99.5		$53,622	$.278	
12 in. Mt. Shasta rainbow	100		6,172	.256	Planted October, 1987.
5-6 in. Lardeau River Gerrard	97.5		406	.083	
5-6 in. westslope cutthroat	99.1		2,044	.069	
2 in. westslope cutthroat	100		4,096	.043	Includes helicopter rental cost.
3 in. Henrys Lake cutthroat		68	1,079	.010	
5 in. Mt Shasta rainbow		67	9,951	.094	
4-5 in. Lake McConaughy rainbow		66	2,635	.031	
4-5 in. Eagle Lake rainbow		84	2,990	.033	
1.5 in. Mt. Lassen rainbow		91	1,447	.032	Includes helicopter rental cost.
6 in. Duncan River Kamloops		55	2,122	.040	
2 in. Pennask River rainbow	99		515	.001	Includes transport cost from Canada.
3 in. rainbow x cutthroat hybrids		80	5,161	.015	Includes costs of mixing hormone.
1.5 in. grayling	100		512	.020	Includes helicopter rental costs.
4-5 in. fall chinook		78	2,738	.045	
4 in. coho		85	50,210	.034	Includes extra costs of intensive daily cleaning.

TOTAL YEARLY COSTS FOR HATCHERY OPERATION = $145,700

[a]Includes costs of eggs, feed, labor, stocking vehicle operation, and materials other than capital outlay.

Table 4. Fish health inspections, October 1, 1987-September 30, 1988.

Sample date	Species/strain	Lot number	Lab log number	VH	VP	VE	BK	PW	Comments
11-2-1987	Rainbow/Tensleep	1-U-Ut	87-149	0	0	0	0	-	
11-13-1987	Rainbow x Cutthroat	7-RCHOR	87-158	0	0	0	0	0	Sterility check; impaired gonads.
4-4-1988	Gerrard/Lardeau R.	7-F-Canada	88-52	-	-	x	x	-	
6-21-1988	Rainbow/wild	none	88-85	x	x	x	x	+	Wild fish from Warm Springs Cr. Presumptive.
6-23-1988	Fall Chinook, Wolf Lodge	7-U-Id-46	88-80	-	-	x	-	-	
6-23-1988	Rainbow/McConaughy	8-En-R6	88-83	-	-	x	-	-	
6-23-1988	Kamloops/Duncan River	8-En-K2	88-82	-	-	-	-	-	
6-23-1988	Coho/Columbia River	8-WS	88-81	-	-	-	-	-	
7-20-1988	Rainbow/wild	none	88-95	x	x	x	x	*	
8-4-1988	Rainbow x Cutthroat	8-RCHOR	88-101	x	x	x	x	x	Sterility check; impaired gonads.

+ = Positive results.
- = Negative results.
0 = Not sampled.
* = Testing in progress.
x = Testing/sampling not feasible
VH = IHNV, infectious hematopoietic necrosis virus.
VP = IPNV, infectious pancreatic necrosis virus.
VE = EIBS, erythrocytic inclusion body syndrome virus.
BK = bacterial kidney disease agent, Renibacterium salmoninarum.
PW'= whirling disease agent, Myxobolus cerebralis.

Table 5. Thirty-day feed comparison study, Mackay Hatchery.

	Rangens	Clear Springs
Number of fish at start	37,296	37,173
Number of fish at end of month	37,268	37,132
Total weight at start	10,134.8	10,421.4
Total weight at end of month	12,207.0	11,338.0
Pounds gained	2,072.2	916.7
Fish per pound at start	3.68	3.57
Fish per pound at end of month	3.05	3.28
Pounds feed used	2,520	2,373
Cost per pound of feed	$0.2038	$0.216
Cost per pound of fish gained	$0.2478	$0.5592
Hatchery constant	6.37	6.37
Conversion rate of feed	1.216	2.59

McCALL FISH HATCHERY

ANNUAL REPORT

Prepared by:

Rick Lowell, Fish Hatchery Superintendent 1

INTRODUCTION

Designed primarily to produce summer chinook salmon (Oncorhynchus tshawytscha), McCall Fish Hatchery is also responsible for hatching and rearing various trout species for stocking in area waters as well as operating a put-and-take rainbow trout (Salmo gairdneri) redistribution program. Annual funding for these two resident fishery programs is provided by the Idaho Department of Fish and Game during the period of April 1 through September 30.

SPAWNTAKING OPERATIONS

Operation of the trap at Fish Lake began on April 15 and continued through May 26, 1988. During this period, a total of 2,710 westslope cutthroat trout (Salmo clarki) were trapped. This total is thought to be artificially high due to suspected movement of fish between the trap and holding ponds. Females trapped ranged in size from 250 mm (9.84 inches) to 445 mm (17.52 inches), with a mean total length of 319.3 mm (12.7 inches) (Figure 1). Males were slightly larger, ranging in size from 240 mm (9.45 inches) to 390 mm (15.35 inches), with a mean total length of 331.28 mm (13.04 inches) (Figure 2).

Spawning operations began on April 27 and continued through May 26, 1988. Spawning was performed three days a week this year, in contrast to twice a week in 1987. All fish exhibiting obvious rainbow trout characteristics were spawned separately and removed from the Fish Lake population. Eggs collected from these culls were incubated and reared separately at McCall Hatchery and planted into waters where an unspecified cutthroat stock was requested. A summary of spawning activities is presented in Table 1.

FISH PRODUCTION

Only two species of trout were hatched and reared at McCall Hatchery this year. Eggs for the production of westslope cutthroat were obtained from spawntaking operations at Fish Lake, while rainbow trout eggs were purchased from Mt. Lassen Trout Farms, Red Bluff, California. A summary of total fish production at McCall Hatchery is presented in Table 2. All production goals were exceeded at McCall Hatchery in 1988 (Table 3).

All trout reared at McCall Hatchery during 1988 were fed Rangens soft-moist diet in various sizes. A total of 260.6 kg (574 pounds) of feed was used to produce 489.93 kg (1,079.15 pounds) of trout at a cost of $432.37, or $0.88 per kg ($0.40/pound) and at a conversion of 0.53.

FISH STOCKING AND TRANSFERS

Fry Transfers

During August, **a** total of 100,000 westslope cutthroat fry were transferred to Mackay Hatchery to fill high mountain lake stocking requests in Region 6. An additional 32,226 rainbow fry in excess of hatchery needs were transferred to Hagerman State Hatchery in September (Table 4).

Broodstock Transfers

During spawning operations at Fish Lake, all broodstock exhibiting rainbow trout characteristics, such as weak throat slashes, irregular spotting pattern, or large scales, were culled from the population and transferred to Goose Lake. A total of 64 fish, 10.9 kg (24 pounds), were culled from the population this season.

Put-And-Take Stocking

McCall Hatchery is responsible for stocking put-and-take rainbow trout (9-inch plus) in portions of Regions 2 and 3, including Adams, Idaho, Valley, and northern Washington counties (Figure 3). Redistribution of 9- to 10-inch rainbow trout began on May 23 and was completed on September 7, 1988. With the exception of Hornet Creek, East Fork of Lost Creek, Lost Creek below Lost Creek Reservoir, and the West Fork of the Weiser River, all put-and-take stocking requests were met this season. These waters were not planted due to low water conditions caused by severe drought. A total of 130,701 9- to 10-inch rainbow trout (19,779.4 kg, 43,567 pounds) averaging 3.0 fish per pound were stocked into 46 lakes, streams, and reservoirs throughout Regions 2 and 3. This figure is slightly up from the 124,780 fish, 19,066.3 kg (42,034 pounds), stocked in 1987.

Fry Stocking

Fry were stocked into 193 mountain lakes during 1988. This total is comprised of 176 lakes which were stocked by fixed-wing. aircraft, 3 of which were stocked by horseback, 13 by backpacking, and 1 by the use of motorcycles. Low water conditions in Ann's Lake (Catalog 107-00-00-0399) prevented it from being stocked as planned. All other lakes were stocked as requested. Total cost for aircraft rental was $5,676.00 or $29.41 per lake as compared to $23.71 per lake last year. The packstocks were made available at no charge. In addition to mountain lake stocking, two lowland lakes were stocked by truck. A summary of fry stocking operations is presented in Table 5.

FISH LAKE BROODSTOCK OPERATION

In 1977, Idaho Department of Fish & Game purchased the Fish Lake impoundment. The permanent trapping and spawning facility, including stream channel alterations, were completed in Fish Lake and Fish Lake Creek before westslope cutthroat trout were introduced into the system.

The Fish Lake broodstock program was initiated in 1978 when 3,360 two-year-old fish averaging 4.2 per pound were introduced into the lake (Table 6). These fish originated from eggs taken at Kings Lake, Washington, in 1976 and incubated at Dworshak National Fish Hatchery. After hatching, these fish were transferred to Rochet Pond near Lewiston and held there before being transferred to Fish Lake. Kings Lake has been successfully maintained by Washington as a brookstock lake since 1945 when they eradicated brook trout and introduced westslope cutthroat trout from Granite Creek, a tributary of Priest Lake in Idaho.

The next stocking occurred in 1980, when 4,350 fish averaging 29.0 per pound were planted. Beginning in 1982, Fish Lake has been stocked in the fall with westslope cutthroat trout fry resulting from the spring's egg take. In 1983, an additional stocking of 498 six-inch plus westslope cutthroat trout occurred. These fish originated from the 1982 Fish Lake year class that were reared at the Eagle Hatchery.

SPAWNING OPERATIONS

Egg taking operations at Fish Lake began in 1982 after the completion of the permanent trapping and spawning facility. The number of westslope cutthroat trout trapped at Fish Lake has increased steadily since the program began, with egg takes ranging from 271,906 in 1984 to 737,932 in 1988. The number of females spawned has also increased. Fecundity rates up through 1986 had declined significantly. However, fecundity rates since 1986 appear to be fluctuating (Table 7). In addition, the ratio of females to males in the spawning run has been increasing since the Fish Lake broodstock program began.

The average length of female cutthroat trout trapped at Fish Lake has decreased as shown in Table 8.

GENETICS

The primary objective of the Fish Lake program is to produce a genetically pure stock of westslope cutthroat trout for distribution throughout the state. For the past few years, there has been a question about the genetic purity of the westslope cutthroat trout broodstock present in Fish Lake. As early as 1981, fish began showing up in the trap that appeared to exhibit rainbow trout characteristics. In the spring of 1986, progeny from the Fish Lake broodstock being held at the Clark Fork Hatchery were electrophoretically tested for genetic purity by Robb Leary at the University of Montana. Results indicate that the percentage of pure westslope cutthroat trout genetic material averaged over the six diagnostic loci examined was 98.0% (+ 1.1%).

After reviewing this information and discussing it with various biologists, it was decided to attempt to control future dilution of the gene pool. Prior to 1986, those fish trapped that clearly exhibited rainbow trout characteristics were simply returned to the reservoir. In 1986, fish exhibiting rainbow trout characteristics were spawned separately and placed in Lost Valley Reservoir, thus eliminating them from the drainage as well as providing a benefit to the angling public. Eggs taken from these culls were incubated and reared separately at McCall Hatchery and planted in waters requesting unspecified cutthroat trout.

Characteristics that were examined to determine whether a fish should be culled were spotting pattern, coloration of the throat slashes, general body coloration, and scale size. To be consistent, only management staff of the McCall Hatchery decided which fish were to be culled. By no means is this type of "eyeball" culling intended to correct the problem of genetic purity. It is felt, however, that it may be used as a tool to remove those fish that are most likely to further degrade the genetic purity of the Fish Lake broodstock.

In addition to eyeball culling, another alternative would be to request gametes and/or progeny from a known source of genetically pure westslope cutthroat trout to breed with the current population in Fish Lake. If this can be accomplished for at least four generations, the Fish Lake stock will become 99.75% pure westslope cutthroat trout. A minimum of 200 pairs of adults should be used when attempting this, so as not to limit the gene pool. It is extremely important that all sources of westslope cutthroat trout used be certified disease free. In addition, efforts should be continued to prevent further degradation of the genetic purity of the Fish Lake broodstock by culling those fish clearly exhibiting rainbow trout characteristics.

By differentially marking these fish, we will be able to identify them at spawning time, thus allowing us to upgrade the genetic integrity of the stock without interfering with programs already in effect.

POPULATION SIZE

In 1986, a population analysis was conducted at Fish Lake. Sampling methods included hook-and-line and electrofishing. Both methods seemed to select for larger fish (age 2+ and older), so the population estimate can be considered for these fish only. The Schnabel population estimator (Everhart et al. 1975) was used to develop a population estimate of 7,201 fish for Fish Lake. However, confidence intervals were quite wide (5,173 to 11,844) (0.95).

Length frequency data collected from fish trapped in 1986 indicate the mean length of mature fish to be 11.35 inches. By combining this data with an assumed condition factor of 0.00035, an average weight of 0.512 pounds per fish was derived. With a population estimate of 7,201 fish, total biomass of fish aged 2+ and older is estimated to be 3,687 pounds.

In 1985, 10,209 fry were stocked in Fish Lake. Assuming a 50% mortality rate on these fish, and an average size of 7.0 inches, we calculated the age 1+ fish biomass in Fish Lake to be approximately 602 pounds. By adding the age 1+ biomass to the age 2+ biomass, the estimated total biomass in Fish Lake is approximately 4,289 pounds.

Carrying capacity of Fish Lake was determined using Ryder's morphoedaphic index (Ryder et al. 1974). Conductivity was measured near the inlet and outlet during the low water period, and an MEI of 18 was calculated. Based on this value, the estimated carrying capacity of Fish Lake is 205 pounds per surface acre. Fish Lake has a surface area of approximately 17.7 acres during the low water period, resulting in an overall carrying capacity of 3,629 pounds.

By subtracting the carrying capacity from the approximate biomass in the lake, we see a difference of 660 pounds. Using the average weight per fish in the lake, this represents 1,289 fish above the calculated carrying capacity.

Table 1. Results of cutthroat trout spawn taking operations at Fish Lake, 1988.

Species	Females spawned	Eggs collected	Percent eye-up	Average fecundity
cutthroat	1,568	737,932	83.6	476
cutthroat culls	41	18,634	82.5	454
TOTAL	1,609	756,566	$\bar{x}$ =83.5	$\bar{x}$ =475

Table 2. Total production of cutthroat and rainbow trout fry at McCall Hatchery, 1988.

Species	Eyed eggs received	Fish produced	Percent survival	Pounds produced
cutthroat	617,155	504,653	81.1	892.23
cutthroat culls	15,068	9,386	62.3	21.70
rainbow	100,000	88,476	88.5	165.22
TOTAL	732,223	602,515	x=82.3	1,079.15

Table 3. Fish requested and produced at McCall Hatchery, 1988.

Species & size	Production goal	Actual production	Percentage of goal achieved	Cost
Cutthroat trout 1 in. +	420,450	514,039	122	$15,860
Rainbow trout 1 in. +	47,500	88,476	186	$8,845
Rainbow trout 9 in. + redistribution	122,200	129,451	106	$5,795

Table 4. Fry transfers from McCall Hatchery, 1988.

Species	Number transferred	Pounds transferred	Station receiving
cutthroat	100,000	134.70	Mackay
rainbow	32,226	93.60	Hagerman
TOTAL	132,226	228.30	

Table 5. Results of fry (1 inch to 1.5 inches) stocking by method and species from McCall Hatchery, 1988.

Stocking method	Species	Number stocked	Pounds stocked
Air	cutthroat	122,250	138.44
Air	rainbow	50,250	56.74
Air	grayling	19,350	3.95
Backpack	cutthroat	7,500	9.70
Backpack	rainbow	3,000	4.88
Horsepack	cutthroat	1,500	1.94
Motorcycle	rainbow	3,000	10.00
Truck	cutthroat	266,094	603.50
Truck	cutthroat culls	9,386	21.70
TOTAL		482,330	850.85

Table 6. Stocking history of westslope cutthroat trout in Fish Lake.

Year	Number	Pounds	Number/ pound	Year class	Source
1978	3,360	800	4.2	1976	Kings Lake, WA
1980	4,350	150	29.0	1979	Hayden Creek, ID[a]
1982	9,828	29.3	336.0	1982	Fish Lake
1983	9,324	37.0	252.0	1983	Fish Lake
1983	498	47.0	10.6	1982	Fish Lake[b]
1984	4,807	20.5	234.0	1984	Fish Lake
1985	10,209	65.9	155.0	1985	Fish Lake
1986	5,490	43.3	126.9	1986	Fish Lake
1987	4,000	24.4	164.1	1987	Fish Lake
1988	3,310	10.1	327.7	1988	Fish Lake

[a]Reared at the Clark Fork Hatchery. The original source was from the 1975 Kings Lake year class.
[b]These fish were reared at the Eagle Hatchery.

Table 7. Numbers of fish trapped, eggs taken, fecundity rates, and female to male ratios at Fish Lake.

Year	Females trapped	Males trapped	Total trapped	Females spawned	Eggs	Eggs per female	Female to male ratio
1982	478	352	830	401	350,802	875	1.36
1983	393	284	677	389	274,490	706	1.39
1984	449	308	757	400	271,906	680	1.45
1985	952	454	1,406	834	362,858	435	2.10
1986	-	469	2,091[a]	925	323,178	350	1.97
1987	3,103	1,383	4,486[a]	959	463,890	493	2.24
1988	1,779	929	2,708	1,568	737,932	476	1.91

[a]This is the number that was reported as trapped after the spawning season was complete. There was a substantial difference between numbers trapped and numbers spawned. We feel that there is movement between the holding ponds and the trap, and some of these fish are being counted more than once.

Table 8. Average lengths of female and male westslope cutthroat trout trapped at Fish Lake.

Year	Females	Male
1982	13.9	12.9
1983	14.0	12.8
1984	14.1	11.8
1985	12.3	11.9
1986	12.3	12.2
1987	12.4	13.0
1988	12.7	13.0

Figure 1. Length frequency of female westslope cutthroat trout trapped in 1988.

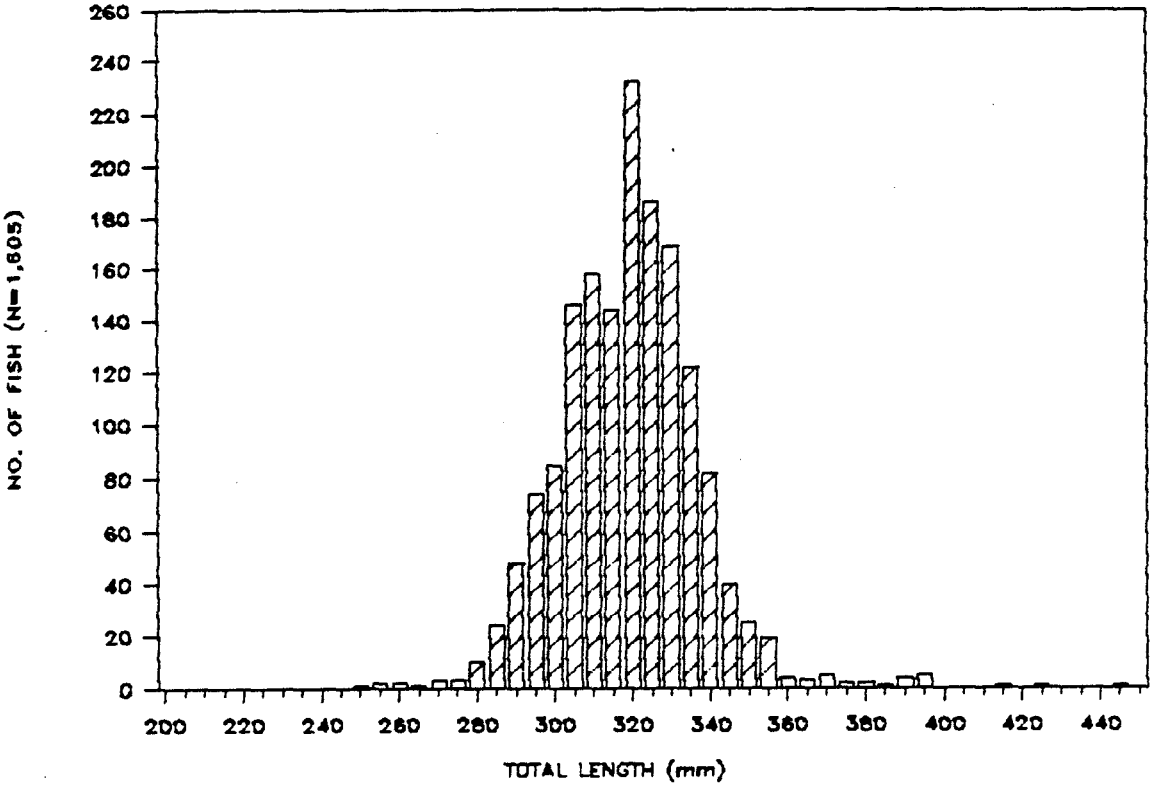
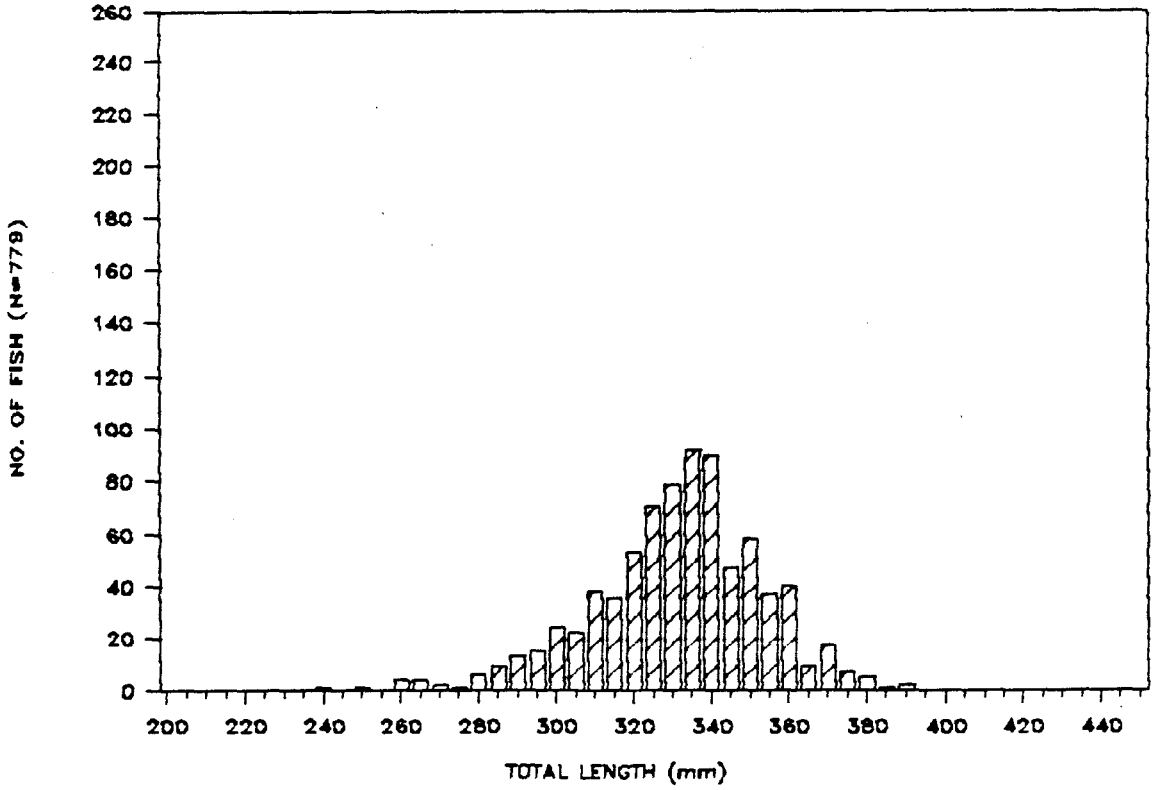


Figure 2. Length frequency of male westslope cutthroat trout trapped in 1988.



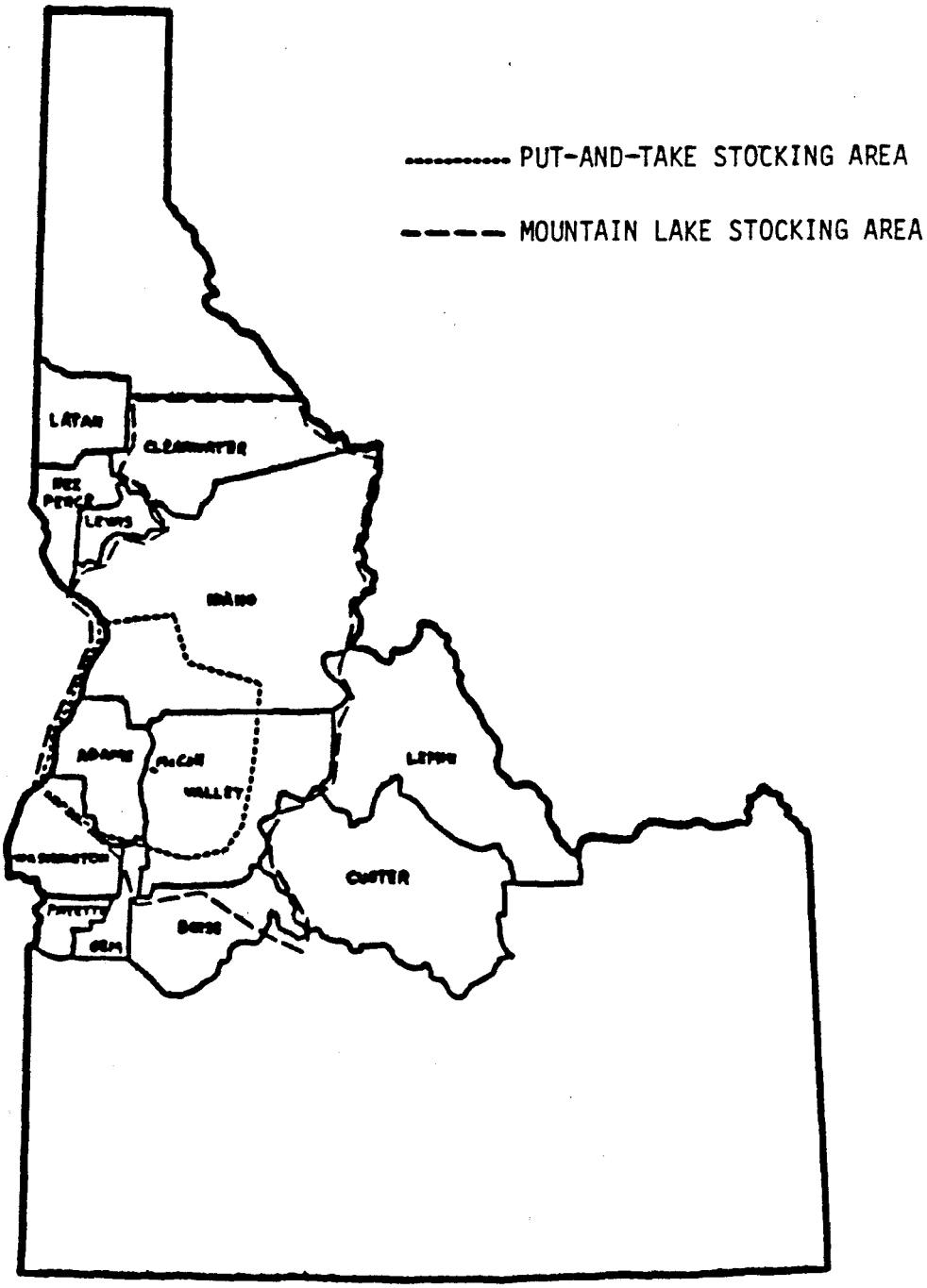


Figure 3. Put-and-take and mountain lake stocking area covered by McCall Hatchery, 1988.

NAMPA HATCHERY

ANNUAL REPORT

Prepared by:

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INTRODUCTION

Nampa Hatchery is a salmonid rearing facility located 2 miles south of Nampa. The water supply includes eight artesian wells with a combined flow of 18 to 34 cfs of 59^0F water. Built in 1975 and purchased by the Department in 1982, fish rearing facilities consist of: a hatchery crew quarters building with four upwelling incubators and four early rearing vats, outside rearing tanks include 16 fry raceways, 3 fingerling raceways, and 10 production raceways. A settling pond treats flows from the production units before discharge into Wilson drain.

Nampa Hatchery stocked 1,122,902 fish totaling 240,789 pounds during fish year 1987-1988. Further breakdown by size is listed in Tables 2 through 5. Rainbow trout of various strains were the major fish produced, totaling 829,510 fish and 206,366 pounds. In addition, Kamloops, brown trout, and Lahonton cutthroat were produced (Table 1).

HATCHERY IMPROVEMENTS

During the 1987-1988 production year, water flows fluctuated at Nampa Hatchery. Flows at the hatchery are related to the level of Lake Lowell and the New York Canal (Figure 1). These waters are Bureau of Reclamation controlled and heavily impacted by the 1987-1988 drought. The hatchery crew undertook a headbox alteration project with consultation from the Engineering Bureau. Water levels in the headboxes of the A, B, and C ponds were lowered. "Head" was effectively lowered, and a 5 cfs gain of flow was realized without compromising water quality.

Because of problems created by the loss of flow, the electrical system was upgraded. Bureau of Engineering and hatchery personnel installed 220 volt service to "B" and "C" ponds at multiple locations. Aerators were purchased to boost dissolved oxygen levels to acceptable ranges.

A base radio was installed in the office. Communications have increased time effectiveness at the hatchery.

The 2-ton fish transport truck from American Falls was obtained and modified to stock area waters. A 3/4-ton pickup truck was added to the hatchery fleet to accommodate the trapping and spawning projects (kokanee and redband).

Three hundred and sixty arborvitae were planted as a landscaping, beautification project.

A new hatchery sign was constructed and continues to draw compliments from many visitors.

FISH PRODUCTION

The past production year marked a change of operations at Nampa Hatchery. Besides the normal production of rainbow trout, Nampa Hatchery assumed responsibility for rearing brown trout because of Eagle Hatchery's closure. Also, Bureau direction to enhance the Owyhee County fisheries gave Nampa the responsibility of rearing Lahonton cutthroat. Water quality parameters at Nampa proved compatible with both species, from the eyed egg stage through their release as fingerlings.

Production in terms of poundage produced (240,789 pounds) during last year was only 4% less than the historical goal of 250,000 pounds despite reduced flows. Flows as low as 18.18 cfs out of a normal 34 cfs were recorded during this period. Careful monitoring of flows and dissolved oxygen, aeration, reprogramming fish production, and some early plants made the above production possible.

Brown Trout

Approximately 234,000 brown trout eggs were received from Plymouth Rock Hatchery in Plymouth, Massachusetts, on December 10, 1987. Early survival was low compared to rainbow because fish did not accept feed initially. Also, some cannibalism occurred after the fish were moved into the production raceways. In the future, grading will be done to eliminate this problem.

The brown trout were stocked between April and October and ranged in size from 3.8 inches to 8.2 inches during this time. The overall feed conversion was 1.4:1.

Lahonton Cutthroat

Nampa Hatchery received 200,000 eggs from the Omak Hatchery in northern Washington on the fourth of May. Four months later, 66,000 fingerlings averaging 82 fish/pound and 3 inches long were released into four reservoirs in Owyhee County. These fish had an average

conversion of .96:1. Six months after receiving the eggs, another 110,000 fingerlings were planted into Lake Lowell and Crane Falls Reservoir. These fish averaged 40 fish/pound and were 4 inches long. The average conversion for this group was 1.34:1.

FISH HEALTH

Status as specific pathogen free was maintained for the third consecutive fish year. During the past year, 18 fish examinations were conducted by the Fish Health Lab at Eagle. All tests for BKD, Myxobolus cerebralis, Ceratomyxa shasta, IPN, IHN, enteric redmouth, and furunculosis were negative.

Minor outbreaks of myxobacteriosis were successfully treated with TM-50 at 2.5 g/100 pounds for 15 days and with a Benzalkonium Chloride bath at 2 ppm for one hour every third day for the first 10 days of treatment. Bacterial gill disease, with mortalities less than 0.1%, was treated with Benzalkonium Chloride at 1.0 ppm, 1.5 ppm, and 2.0 ppm for one hour for three consecutive days on an "as-needed" basis.

The early kokanee from Deadwood Reservoir have tested negative for the specific pathogens mentioned above for the last three years.

Preliminary disease testing on redbands from Josephine Creek Reservoir and Louisa Creek Resevoir, sampled during April and May 1988, tested negative for IPN, IHN, and BKD.

SATELLITE PROJECTS

Nampa Hatchery was given the early kokanee salmon trapping and spawning project at Deadwood Resevoir from Eagle Hatchery. Despite drought conditions, the Deadwood project has remained a viable source for early kokanee eggs. Trapping of KE adults started on 8/8/88 and ended on 8/24/88. An estimated 7,050 adults were hauled from the trap site near Riverside Campground to the Eagle Hatchery. An egg yield of 1,566,675 eggs was taken from 3,385 females for a fecundity rate of 463 eggs per female. A total of 1,286,895 eyed eggs were shipped to Mackay Hatchery. Eye-up rate was 82.141. The lengths for adult females averaged 11.64 inches and adult males, 11.91 inches (Figure 2).

A redband trapping and spawning project was investigated at Josephine Creek Reservoir and Louisa Creek Reservoir, and a limited number of fish were sampled for fish diseases. Trapping and spawning will be attempted in 1989, with a goal of 100,000 green eggs.

The Kamiah redistribution project was operated through Nampa Hatchery. A total of 42,690 fish weighing 15,500 pounds were hauled to the Kamiah Pond and stocked in Region 2 waters.

SPECIAL PROJECTS

Kokanee egg picking went poorly with a Jensorter. With two year classes spawned, egg size varied. Despite using different sizes of sorting plates, egg trauma resulted. This trauma is believed to be the cause of "secondary" mortality seen' the previous season. A hydrogen peroxide flotation method was used with success. The method involved using the bottom tray from a Heath incubator with the screen box removed. The tray was filled with 4,200 ml of water and 1,400 ml of 31 hydrogen peroxide (1% solution). A screened tray of shocked eggs can be placed into the solution. The dead eggs will float and can be skimmed off. Up to 120,000 eggs can be "picked" per batch of solution. Eye-up rates were reasonable (averaged 82.141) and "secondary" mortality was eliminated. Posthatching survival ranged from 79% to 88% (Bill Doerr and Paul Abbott, personal communication).

Additional incubation space was needed at Eagle Hatchery for the 1988 KE egg take of 1,566,675. Three upwelling incubators were plumbed into the existing supply line. Incubators were 1-foot diameter PVC, 30 inches high. A manifold of 3/4-inch "tees" and 90 degree elbows pointed towards the bottom of each incubator. Above the manifold was attached a screen, and 2 inches of aquarium gravel medium was added. Flows of 5 to 6 gpm were required to gently roll the green eggs. It should be noted formalin treatments were unnecessary. Eye-up percentages ranged from 63 to 87% and averaged 79.61. This was lower than 84.121, the average for the entire egg take. Egg survival was directly related to gas bubble disturbance intensity. Two of the upwellers were plagued with gas bubbles "burping" through the eggs, despite efforts to seal all joints and eliminate leaks. The upshoot of this is that green eggs can be incubated in upwellers without formalin treatment with survival equal to Heath stacks and formalin treatment.

PUBLIC RELATIONS

An estimated 4,500 people visited the hatchery this past fish year. Tours were given to organized groups such as YMCA, scout, and area school groups. Also, hatchery personnel gave presentations to Hunter Education classes in the Nampa area.

The settling pond was fished by handicapped groups from the Veteran's Home and State School. The local newspaper covered this event with a great write-up and picture of a handicapped person with a 5.5 pound rainbow.

Area sportsmen's groups, Gem State Fly Fishermen, Idaho Free Trappers, Nampa Rod and Gun Club, and Nampa Bow Chiefs, utilized the conference room for monthly meetings. 4-H groups also used this facility for monthly meetings.

A television media blitz included national coverage relating to the drought, kokanee trapping and spawning, stocking the Boise River with "large" catchables, and the use of aeration to cope with low water flows at Nampa.

Table 1. Fish requested and produced.

Species & size	Production goal	Actua production	Percentage of goal achieved
Rainbow 6+ inches	724,600	829,510	114%
Kamloops 3-6 inches	124,000	95,700	77%
Kamloops 6+ inches	0	107,751	excess
Brown 2-6+ inches	125,000	83,331	67%
Lahonton 2-5 inches	0	66,010	new program

Table 2. Eggs received at Nampa Hatchery, October 1, 1987 to September 30, 1988.

Species/ strain	Date received	Source	Number	Percent hatch	Destination	Expected yield	Cost/ 1,000
Kamloops K1	10/13/87	Skanes	200,000	85	Region 3	145,000	7.00
Kamloops K1	11/10/87	Skanes	200,000	85	Region 3	145,000	7.00
Brown BN	12/20/87	Plymouth	234,000	86	Region 3	168,000	7.50
Rainbow R5	1/20/88	Ennis	57,190	84	Region 3	40,000	n/c
Kamloops K1	2/2/88	Skane	200,000	85	Region 3	145,000	7.00
Rainbow RFL	3/17/88	Erwin	230,720	81	Region 3	160,000	n/c
Cutthroat C6	5/4/88	Omak	200,025	85	Region 3	140,000	n/c
Rainbow R4	6/8/88	Mt. Lassen	200,000	84	Region 3	145,000	7.95
Rainbow R4	6/29/88	Mt. Lassen	200,000	83	Region 3	145,000	7.95

Table 3. Fry production at Nampa Hatchery.

Species/ strain	Source & date	Number received	Yield number	Yield pounds	Percent survival egg to plant	Destination	Cost/ fish	Comments
Brown BN	Plymouth, 12/10/87	234,000	11,269	119	86	L. Wood R., 4/18/88	.014	R. maxillary clip
----------	(Most of this lot was stocked at larger size.) ----------							
Cutthroat Lahonton	Omak, 5/4/88	200,025	66,010	805	83	Grasmere, Shoofly, & Bybee reservoirs	.0036	

Table 4. Fingerling production at Nampa Hatchery.

Species/ strain	Source & date	Number received	Yield number	Yield pounds	Percent survival egg to plant	Destination	Cost/ fish	Cost/ pound
Brown BN	Plymouth, 12/10/87	234,000	65,192	2,237	73	Region 3	0.011	0.32
Kamloops K1	Skane, 10/13/87	200,000	95,700	5,500	66	Hayden Lake	0.018	0.32
Totals		434,000	160,892	7,737				

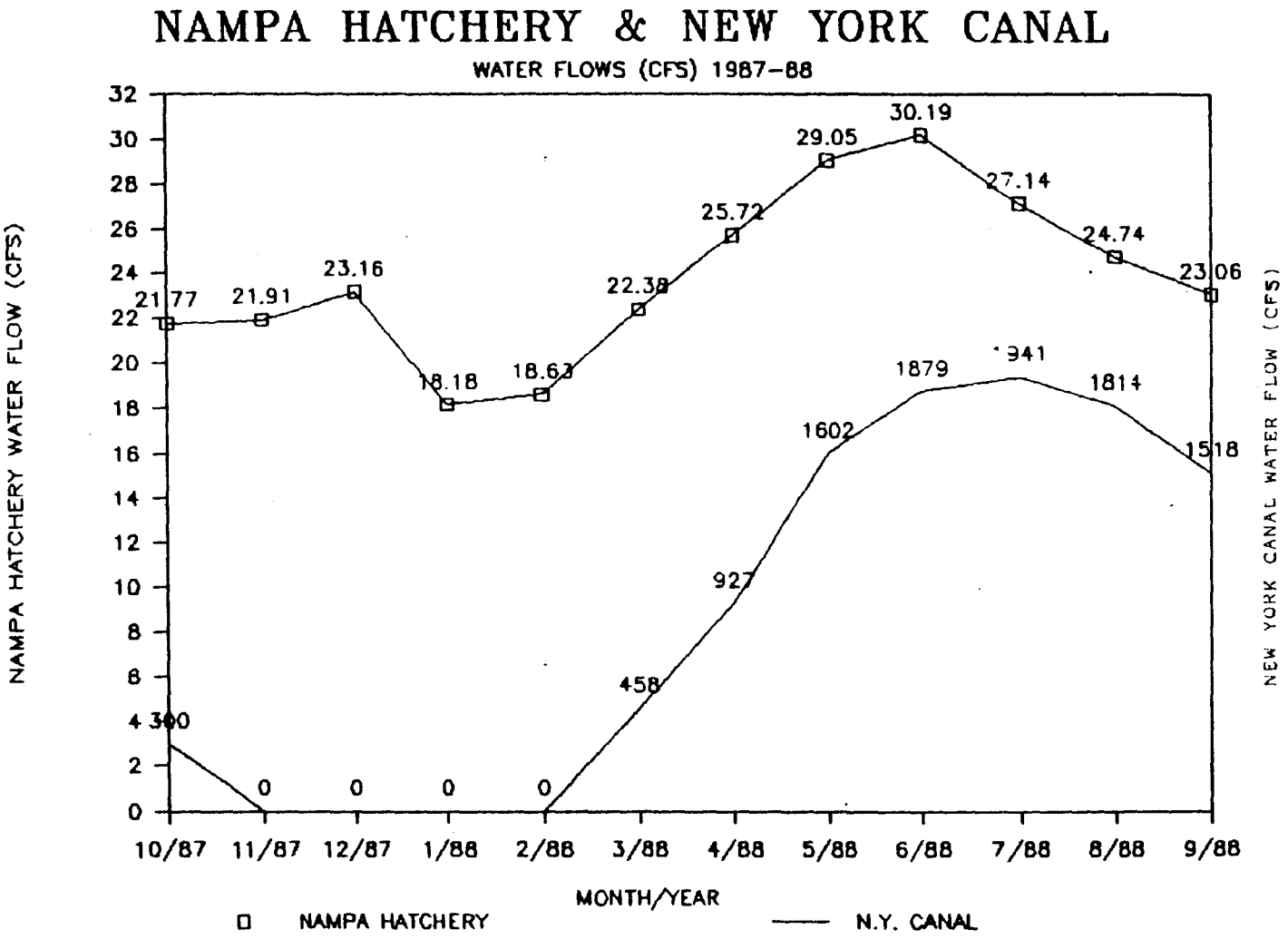

Figure 1. Nampa Hatchery and New York Canal water flows, 1987-88.

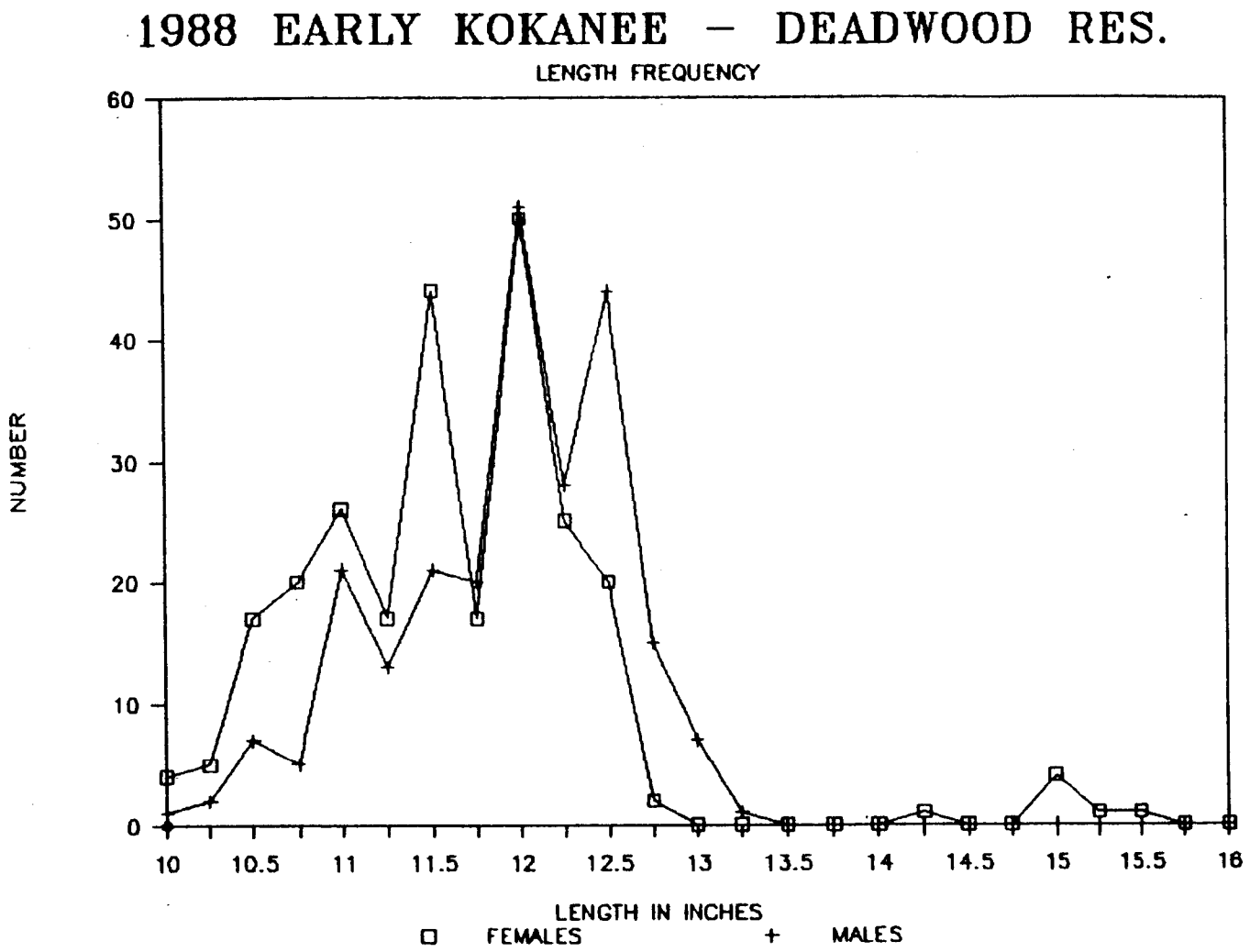

Figure 2. Kokanee length frequencies from Deadwood Reservoir, 1988.

Table 5. Catchable production at Nampa Hatchery.

Species/ strain	Source & date	Number received	Yield number	Yield pounds	Percent survival egg to plant	Destination	Cost/ fish	Cost/ pound
Rainbow R4	Mt. Lassen	1,250,000	820,163	203,906	66	Regions 2 & 3	0.065	.26
Rainbow R5	Ennis	57,190	9,347	2,460	65.5	Region 3	0.052	.20
Brown BN	Plymouth, 12/10/87	234,000	6,870	1,648	52.3	N. Fk. Payette, Box Canyon #2, & Riley Cr.	0.152	.63
Kamloops K1	Skane, 10/13/87	200,000	107,751	25,414	50.8	L. Payette Lake Fk. drainage	0.064	.27
Totals		1,741,190	944,131	233,428				